RAILROAD GAZETTE

SATURDAY, JANUARY 4, 1873.

Tremont Street Bridge, Boston.

The Boston & Albany Railroad in entering the city is crossed by a number of bridges carrying the streets, generally over four or five tracks, as the yard-room is very extended. The iron girders which carry Tremont street will be very briefly described in this article.

The bridge is 70 feet wide, with two carriage roadways and two footways, the former being about 24 feet, the latter about nine feet in clear width; the axes of the street and railroad making an angle of 61 deg. with each other. The span on the square is about 49 feet, and the girders have a clear span of 56 feet, being 61 feet in length.

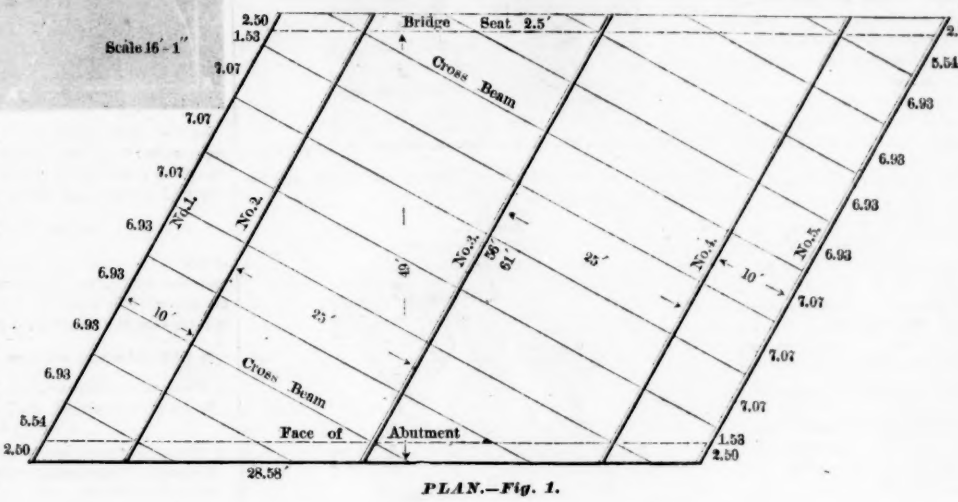
There are five plate-webbed girders, each 6 feet in depth, connected by cross-beams placed upon their lower flanges at right angles to them, and placed at intervals of about 7 feet, the exact distances of all center lines being shown in the plan. The peculiar spacing was apparently adopted in order to divide the distances on the abutments between the three center girders into equal parts by cross-beams, thereby securing an equable distribution of load, and at the same time preserve the exact rectangularity of the cross and main girders. In describing the main girders they will be designated by the numbers they bear in the plan. Numbers 1 and 5 are alike, only differing in being turned end for end, as also are numbers 2 and 4. The center one—No. 3—is properly made heavier than the others, as it carries the halves (on each side) of the two large roadways. Numbers 1 and 5, which carry each only half of the footway, are very much lighter than the other two. All of them act as fences to their respective portions of the bridge. The widths and thicknesses of the web plates can best be seen from the diagrams, where plates of the same thickness are connected at the top, and plates of the same width at the bottom, by a brace (⌒). The figures attached show the dimensions of all the plates so connected.

The joints of the web are covered on each side by a strip 8 inches by ¼ inch in Nos. 2, 3 and 4, and by strips 5 inches by ¼ inch in Nos. 1 and 5.

The web is stiffened by vertical angle-irons at the attachments of the cross-beams at the joints marked in the diagrams by a double line. These stiffeners are a single angle-iron 2½ inches by 2½ inches by ½ inch on the outer side of the web in Nos. 1 and 5, and an angle iron on each side 3½ inches by 3½ by ½ inch in Nos. 2, 3 and 4.

The top and bottom flanges are alike in all the girders, and in No. 3 they are composed of a pair of 3½ inches by 3½ inches by ½ inch angle-irons uniting the web with horizontal flange plates 10 inches by ½ inch, which in the middle portion for a length of 40 feet are in two thicknesses. In Nos. 2 and 4 this additional plate is omitted. In Nos. 1 and 5 there are only a pair of 3 inches by 3 inches by ½ inch angle-irons without any plate. The joints in the plate have covers 2 feet 4 inches long by 10 inches by ½ inch. The joints of the angle-irons are covered for a length of two feet. The positions of these joints is best seen in the diagrams; they are arranged so as to come in the middle of a web plate.

The roadway girders have a plate web 18 inches deep by ½ inch in thickness. The upper flange is a pair of 3½ inches by 3½ inches by ½ inch angle irons in the usual manner, but the bottom flange has the same angle irons with the horizontal wings upwards. This is in order that the wooden stringers placed upon the bottom flange may have a good bearing. The sidewalk girders are with a plate web 10 inches by ½ inch; the flanges of 2½ inches by 2½ inches by ⅛ inch angle irons arranged in the usual manner. The roadway stringers are 12 inches by 5 inches spaced 2 feet from centre to centre, carrying two layers of flooring plank 3 inches in thickness, the upper of oak, the lower of Burnettized spruce. The footway stringers, 5 in each footway, are 4 inches by 8 inches, and are placed on top of the cross-beams; they carry 2-inch flooring plank. The attachment of the floor beams to the main girders is made by riveting the web of the former to the vertical angle-iron stiffeners of the latter, excepting with numbers 1 and 5, where the web of the footway girder is flanged round 2½ inches, and a knee 10 inches long 2½ inches by 2½ inches by ½ inch is added and riveted through the vertical cover-plates of the large girders, making the same joint in effect as the others. A sway brace of bar iron unites the vertical stiffeners to the top flanges of the cross-beams, and adds to the steadiness of the large girders. The rivets in Nos. 2, 3 and 4 are ⅞ inches, and in Nos. 1 and 5 ⅝ inches in diameter. A guard timber, 8 inches by 10 inches, is laid on the floor of the roadways to protect the girders from injury by passing teams.



PLAN.—Fig. 1.

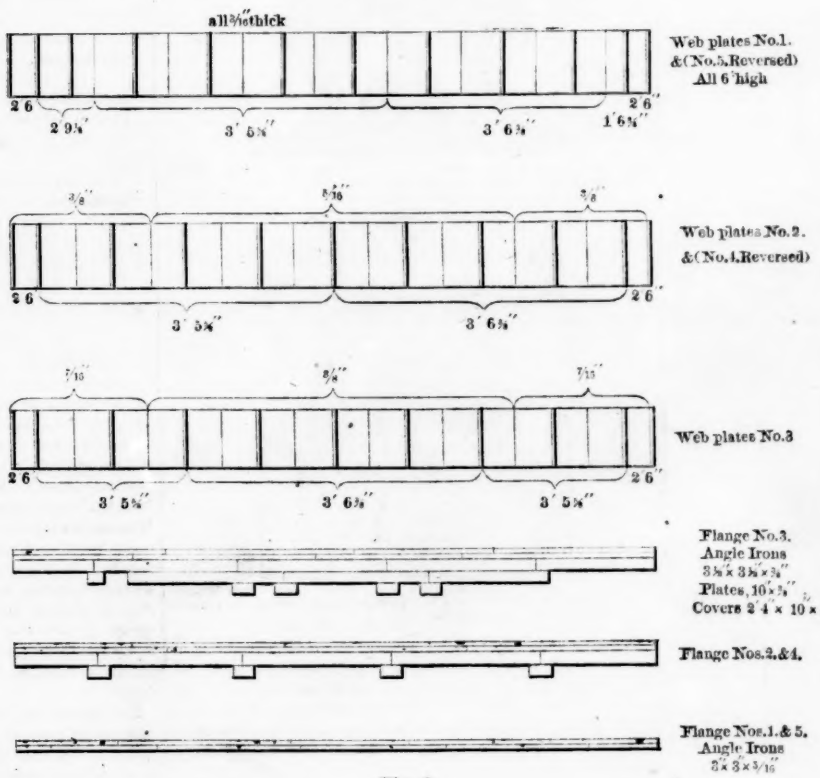


Fig. 2.

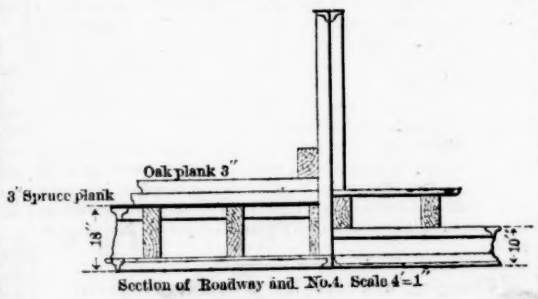


Fig. 3.

These girders represent the practical carrying out of sound theory very exactly, and great pains have evidently been taken with all the details, especially in rendering the communication of weight to the large girders as symmetrical as possible.

Let us now investigate the working load of the bridge. In so doing we will first find the uniformly-distributed load each girder can carry, including its own weight, without producing more than five tons per square inch tension on the metal in any part. The weights of the girders will then be deducted, and also the total weight of the flooring carried by the main girders. This external load will be then reduced to pounds per square foot of area covered.

The estimate of weights has been made on the basis of 480 pounds to the cubic foot for iron, and 10 per cent. added for rivet heads and the well-known overrun of sizes. Minute accuracy will not be attempted, as in cases of this kind it is useless. The total area covered with floor is 4,270 square feet; the clear area, after deducting the bridge seats, is 3,920 square feet.

The center girder weighs $7\frac{5}{16}$ tons of 2,000 lbs. The proportion of flange to web is about 5 to 8. Girders number 2 and 4 weigh together $12\frac{7}{16}$ tons. The ratio of flange to web is about 8 to 15. Numbers 1 and 5 weigh together six tons, the ratio being nearly 1 to 2. The sum of these weights is $26\frac{1}{16}$ tons. The roadway girders weigh in all $16\frac{7}{16}$ tons, their flooring $40\frac{5}{16}$ tons, the sidewalk beams $2\frac{7}{16}$ tons, and the floor 5 tons. Collecting these we find $45\frac{5}{16}$ tons of iron and $45\frac{5}{16}$ tons of wood in the structure. Of this weight ⅔ may be considered as carried by the main girders, or $83\frac{7}{16}$ tons for the span of 56 feet as permanent load.

The distributed working load in tons may be computed by the formula $w = \frac{8fha}{l}$ in which

w is distributed load in tons;

l is length between bearings in feet;

f, working tension on metal per square inch in tons;

h, depth of girder in feet;

a, net area of lower flange = area plates + area angles + ⅛ web area — greatest number of rivet-holes all measured in the cross section.

Putting $\left\{\begin{matrix} l=56 \\ h=6 \\ f=5 \end{matrix}\right\}$ we have $w=4.3\,a$

Computing the values of a from the dimensions given we have, for numbers

1, $a=5\frac{7}{16}$ sq. inches;	$w=24\frac{1}{16}$	tons.
2, $a=11\frac{9}{16}$ "	$w=49$	"
3, $a=15\frac{5}{16}$ "	$w=65\frac{1}{16}$	"
4, $a=11\frac{9}{16}$ "	$w=49$	"
5, $a=5\frac{7}{16}$ "	$w=24\frac{1}{16}$	"

Adding the last column, we find for the supporting power $212\frac{9}{16}$ tons; deducting $83\frac{7}{16}$ tons, we have $129\frac{2}{16}$ tons as the total external distributed load, or 66 pounds per square foot of the clear area.

The strength of the roadway beams being found in the same way gives 15 tons; deducting the weight of the cross beams and flooring, say 5½ tons, we have 9½ tons uniform load, being very properly a greater load per square foot than on the large girders, as the cross beam is loaded by passing wheels on two or more points. The same stress on the metal would be developed by a pair of wheels nine feet apart, carrying four tons on each. The footway beams carry $10\frac{1}{16}$ tons each as total load, of which $9\frac{7}{16}$ may be external, being a very much greater load for the footways than elsewhere—280 pounds per square foot. This appears to be an excessive strength, but it is no doubt judicious to give the footways greater strength than the roadways, as in cities they are more liable to dense crowds as spectators of a procession over the roadway, or of a railroad accident underneath.

Bridges of this class in cities should always be of the most rigid and solid construction, and for such spans and loads the plate girder properly designed has always given satisfaction; the construction is simple, and the connections and parts such as to leave the least material free to vibrate in any way. They are not, perhaps, the most economical of structures, but they appear to be the best for this purpose.

CHAS. A. SMITH.

A Long Train.

The Harrisburg (Pa.) *State Journal* says that a freight train consisting of four locomotives and 128 eight-wheel cars left that place about 6 o'clock on the morning of December 15, on the Pennsylvania Railroad, and reached Altoona the same afternoon. The train was considerably overhalf a mile long.

Lake Erie & Louisville.

This company has made a proposition to the city of Sandusky, O., to make that city the northern terminus of the road, provided a sufficient amount is subscribed in that city. The road is now in operation from Fremont to Lima, O.

The Life of Iron Rails.

[A paper read before the Civil Engineers' Club of the Northwest, December 9, 1872, by L. P. Morehouse.]

I submit to the Club for consideration some facts concerning the actual service performed by what may be called the average iron rails used on the railroads of this country. Statements are often made as to the life of such rails, and the question is frequently asked, How long iron will last in the track? So many circumstances bear upon this question that it is impossible to give a definite answer. The grades and alignment of the road, the amount of traffic, the speed of trains and weight of engines are conditions that affect the solution of the problem; but besides these there is an unknown quantity which is not to be ascertained by any known formula—the particular quality, or want of quality, of the rails themselves.

The statistics which I present may be of interest by giving information as to the actual wear of a number of brands of rails, each from a different maker, and therefore fairly representing the average rails of the country.

The road on which these rails were laid is 131 miles long; 77 per cent. of its length tangent, 21 per cent. with curves of less than 5 degrees, and 2 per cent. with curves of over 5 degrees. The grades are: level, 20 per cent.; less than 20 feet per mile, 20 per cent., and between 20 feet and 42 feet per mile, 60 per cent. Its yearly mileage of engines is about 1,000,000 miles. The engines used weigh 30 and 32 tons, have four driving-wheels, and carry five tons on a wheel. The speed of passenger trains in motion is 24 miles per hour, and that of freight trains 15 miles. In justice to the rails, it ought to be added that if trains are behind time they will sometimes run at a greater speed than this.

Examination was made of seven different lots of rails which had been in use from 2¾ years to five years. For convenience, I have numbered the different lots from 1 to 7, the numbers referring to the time when the rails were laid, No. 1 having been laid first and No. 7 last:

TABULAR STATEMENT OF SERVICE OF IRON RAILS.

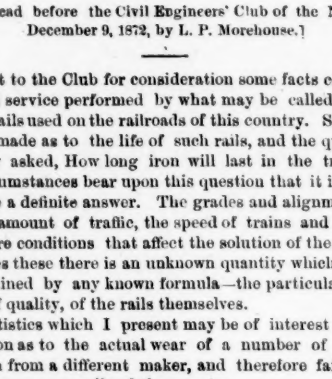
	Total number of bars.	*Per cent. of bars still in use* Good.	Battered.	Per cent. of bars taken out.	Years in use.
No. 1	1,080	60	18	22	5
2	630	66	11	23	4
3	2,520	42	32	26	4
4	1,989	25	28	47	4
5	1,976	46	9	45	3¾
6	392	56	19	25	3
7	396	65	24	11	2¾

Rails No. 1 were made under the following specification:

"The rails are to be made of iron of good quality suitable for rails, and to be subject to the inspection of an agent of the railroad company in all stages of manufacture. No old rails are to be used in the manufacture of the said rails.

The piles from which the rails are rolled are to have a top and bottom piece of reheated iron not less than an inch in thickness, running the whole length of the pile. The said tops and bottoms are to be manufactured from puddled flats not more than ⅞ of an inch in thickness, and the whole process is to be carried on under the supervision of —— ——, Esq., with the distinct understanding that he shall see that the iron is good, and the rails properly made, and will give his certificate accordingly."

No. 2.



A, Old rail. B, Muck bar. C, Old rail. D, Old rail.

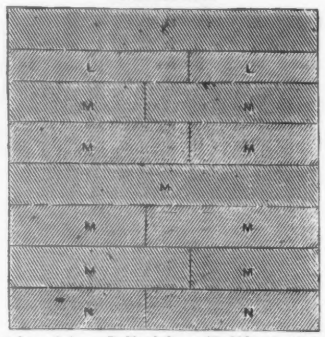
Rails No. 2 were made from a pile 7½ inches base, 8½ inches height, made up of two flats at bottom and two flats at top, the space between these flats filled in with three pieces of old rails; the lower two flats and the top flat made from old rails, the second top flat from muck bar. Bottom flats each 1 inch thick, top flat 1½ inches, and muck bar ⅞ inch thick.

Nos. 3, 4 and 5 were made at different mills under the same specification:

"The rails are to be made from a pile at least 8 inches by 8 inches, of which the head or top piece shall be composed of best No. 2—or reheated—iron, at least 2 inches in thickness, made wholly from puddled bars puddled from pig iron, in which no cinder mine has been used; in other words, the pig iron used for the head piece shall be made from good native ore alone, without any admixture whatever of cinder. The remainder of the pile shall be put together so as to break joints, with as few short pieces of iron as possible, and of such quality as will give a good, tough, fibrous flange on the base. Both the head pieces and the rail piles shall be bloomed in the usual manner, and reheated to a good soaking heat before the final rolling. All the materials and processes employed in the manufacture of these rails shall be the same as if they were to be guaranteed for seven years, but in lieu of such guarantee the railroad company will trust to the honor of the makers to comply with this provision. An inspector may be sent to the works to supervise the manufacture of the rails and to pass them on final delivery; but if no inspector be provided, the manager of the works will consider this duty as confided to his honor."

No. 6 rails were made from a pile 7½ inches base, 7¾ inches high, composed of 8 layers of flats each one inch thick, except the one next below the top plate, which was ¾ of an inch thick. The top flat and the fourth from the bottom were 7½ inches wide, the others were composed of pieces 3 inches and 4½ inches wide; the different flats breaking joints. The bottom piece was

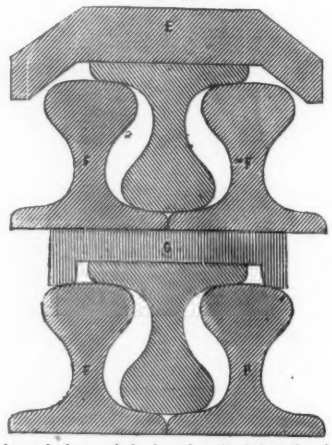
No. 6.
7½ inches wide.



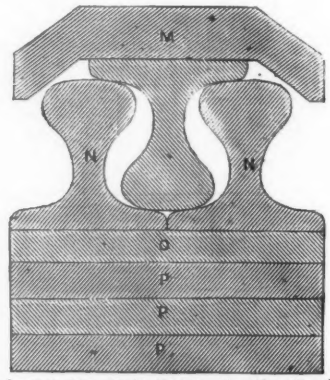
K, Reheated muck bar. L, Muck bar. M, Old rail N, Scrap iron.

from scrap iron, the top piece of reheated muck bar, and the one next below of muck bar.

No. 7.



E, Reheated muck bar, whole length. F, Old Rail, whole length. G, Muck bar. This is the pile usually used.



M, Reheated muck bar, whole length. N, Old rails, whole length. O, Muck bar. P, P, P, Old rails. This pile is used when short pieces of old rails have accumulated.

The pile for No. 7 rails was composed of a base consisting of 3 pieces of old rails, 2 placed side by side and the third inverted between them; a muck bar ¾ inch thick rests on base of the inverted rail, with its ends turned down to rest on the outer pieces. Three old rails rest on this flat, arranged as in the base, and a reheated muck bar 1¼ inch thick with ends turned down makes the head.

This pile received six passes, rolling it into a bloom about 6 feet long and 5½ inches by 6 inches. It was then reheated and afterwards rolled into a rail.

The rails originally laid are made from a pile 7 inches base and 7½ inches height, of 6 flats, each 1¼ inches thick and 7 inches wide, the one next above the bottom piece composed of short pieces 7 inches square and placed with the fiber at right angles to the direction of the pile. The top flat was made of a granular iron double-worked, the others of single-worked iron, the bottom flat being of good fibrous iron. This pile received 4 passes through box rolls at a speed of 18 inches per second, was then reheated to a welding heat and received 8 passes through draft rolls at a speed of 6 feet per second, being worked edgewise through the draft rolls.

I cannot give exact data concerning the wear of these rails, but I find that after a service of 11 years 33 per cent. were in good condition. The mileage for these years was, however, less than that considered for the other rails, so that 5½ years' service of the latter would be equal to 11 years service of the original rails.

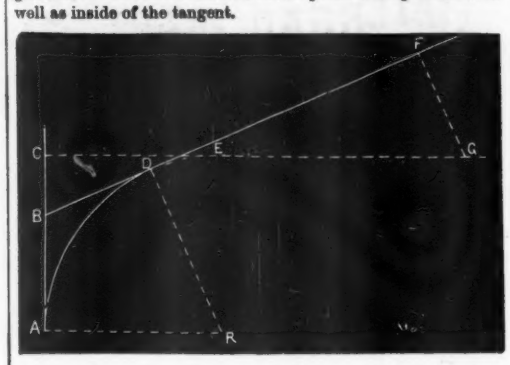
Changing a Curve for Different Tangents.

CHESAPEAKE & OHIO RAILROAD,
NEW RIVER, W. Va., December 20, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following original formula for the solution of the problem proposed by your correspondent, "R. O. B.," in the number for December 7, will be found correct within limits sufficiently extended for all practical purposes.

As the problem is a very common one in field work, for the use of the draughtsmen among your readers the formula is made general, so as to cover the case of the point falling outside as well as inside of the tangent.



In the figure given by "R. O. B.," let the tangent DF be represented by d; the perpendicular FG from the tangent to the given point by e; the radius of the curve by R, and the required central angle of decrease or increase by x. Then:

$$\text{nat. tan } x = \frac{d \mp \sqrt{d^2 + 2R \times e}}{R}$$

in which the sign "∓" expresses "the difference between," and the plus or minus sign is to be taken accordingly as the given point falls outside or inside of the tangent. Where it falls outside, the formula is correct to within half a minute when $\frac{e}{d} = 0.15$, and where inside when $\frac{e}{d} = 0.12$, the error lessening as these values decrease.

When x is calculated, the formula for verification is:

$$e = (d \pm R \tan \tfrac{1}{2}x) \tan x$$

in which the plus or minus sign is taken as before.

Example.—Point falling outside of tangent:

Given $R = 2000$; $e = 100$; $d = 1000$.

$$\tan x = \frac{1000 \mp \sqrt{1000000 + 2 \times 2000 \times 100}}{2000} = \frac{1000 \mp 1183.22}{2000}$$

$$= 0.09161 = \tan 5° 14'$$

Verification:

$$e = (1000 + 2000 \times 0.0437)\, 0.09161 = 99.98$$

Example.—Point falling inside of tangent:

Data as before.

$$\tan x = \frac{1000 \mp \sqrt{1000000 - 2 \times 2000 \times 100}}{2000} = \frac{1000 \mp 774.6}{2000}$$

$$= 0.1127 = \tan 6° 26'$$

Verification:

$$e = (1000 - 2000 \times 0.0562)\, 0.1127 \quad 100.03$$

CONWAY R. HOWARD.

Practical Field Engineering.

NO. XII.

CROSS-TIES.

A very important and quite frequently a very vexatious par of the duties of the railroad field engineer is that of looking after the cross-ties to be used on his line of road. To make the performance of this labor easy and satisfactory, a knowledge of the nature and durability of different kinds of timber is of the first importance. White-oak, burr-oak, the Southern post-oak and the tough bastard oak growing on the outskirts of our Western prairies are the best kinds of wood for cross-ties, and the value of each may be reckoned in the order in which it stands in the above list. A good cross-tie will "take a spike" without splitting and hold it firmly, while the wood sustains the rail without imbedding it, and for years is proof against decay. I have seen split white-oak cross-ties that had, in a damp Western climate, sustained the weight of an enormous transit of traffic for fourteen years without any sign of general decay.

The dimensions for a good cross-tie, for the common gauge, may be put down at eight feet long and eight inches by six inches in the cross-section. Hewed ties are better than split ones, and split ones better than those that are sawed—that is, as regards durability. Many railroad builders are in the habit of dividing cross-ties into two classes, accepting those of a less cross-section than eight inches by six as second class. This is sometimes good economy.

To make a good railroad you must have good cross-ties and a sufficient number of them. Where heavy fish-bar iron is used, that is, heavy rails with bar-and-bolt joints, 2,800 ties to the mile will, if properly laid and ballasted, be sufficient.

SELECTING TIMBER FOR CROSS-TIES.

It is frequently the case that a company building a line of railroad owns timbered lands, from which the whole or a portion of the ties are to be procured. In such case it not unfrequently happens that the engineer must select the trees to be used for this purpose. A few rules for judging timber by the outside appearance of the trees may not here be amiss. For making split ties, the larger the tree the better. An oak tree that has rough, open bark, the seams of which run in straight lines, will generally split freely. The direction of the "grain" of the wood may be easily known, as it corresponds with that of the bark seams. For hewed ties, smooth-barked thrifty saplings from ten to fourteen inches in diameter are best, and it is not uncommon to find vast groves of such in many of our Western States. First-class ties are made by hewing two opposite and parallel faces on the trunks of these saplings, leaving the latter six inches thick. The hewed pole is then cut into the proper lengths for ties. For sawed ties, large straight trunks free from bad knots, wind-shakes and doted places are the kind to be selected. The direction of the grain, unless very twisting, is immaterial.

DELIVERING CROSS-TIES.

The engineer should see that ties made along the line of th

REGULAR TRAINS.

DOWN.

Miles between.....	Stations.....	Time of passenger at maximum speed....	Time of freight at maximum speed....	No. 2. Schedule time..	No. 2. Actual arrival..	No. 4. Schedule time..	No. 4. Actual arrival..	No. 6. Schedule time..	No. 6. Actual arrival..	No. 8. Schedule time..	No. 8. Actual arrival..	No. 10. Schedule time..	No. 10. Actual arrival..	No. 12. Schedule time..	No. 12. Actual arrival..	No. 14. Schedule time..	No. 14. Actual arrival..	No. 16. Schedule time..	No. 16. Actual arrival..	No. 18. Schedule time..	No. 18. Actual arrival..	No. 20. Schedule time..	No. 20. Actual arrival..	No. 22. Schedule time..	No. 22. Actual arrival..	No. 24. Schedule time..	No. 24. Actual arrival..	No. 26. Schedule time..	No. 26. Actual arrival..
		Minutes.		A.M	A.M	P. M.	P. M.	P. M.	P. M.	A. M.	A. M	A. M.	A. M.	A. M.	A. M.	A. M.		A. M.	A. M.	A. M.		A. M.	A. M.	A. M.		A. M.	A. M.	A. M.		A. M.	
	A	Leave.		6.00	*	3.00	*	4.00	*	7.00		7.30	Can-	8.00	*	8.30	*	9.00		9.30	*	10.00		10.30	*	11.00		11.30	*
6		12	24																										
	B			6.12	*	3.12	3.15	4.12	*	7.24	7.34	7.54	c'll'd.	8.24	*	8.54	*	9.24		9.54	10.00	10.24		10.54	*	11.24		11.54	*
10		23	48										A No. 8																
	C			6.35	*	3.35	3.40	4.35	*	8.12		8.42	8.30 8.42	9.12	9.10 9.40	9.42	*	10.12		10.42	10.52	11.12		11.42	*	P. M. 12.12		P. M. 12.42	*
13		24	50																				Cancelled. A No. 18						
	D			6.59	7.02	3.59	4.10	4.59	* A No. 4	9.11		9.41	*	10.11		10.41	*	11.11	Cancelled.	11.41		P. M. 12.11	12 05 12.15	P. M. 12.41	*	1.11	Cancelled.	1.41	*
8½		17	34																										
	E			7.16	7.20	4.16		5.16	*	9.45		10.15	*	10.45		11.15	*	11.45		P. M. 12.15		12.45	12.50	1.15	*	1.45		2.15	*
9¾		20	40																										
	F			7.36	7.40	4.36		5.36	*	10.25		10.55	*	11.25		11.55	*	P. M. 12.25		12.55		1.25	1.35	1.55	*	2.25		2.55	*
7½		13	28											P. M.		P. M.													
	G			7.49	*	4.49		5.49	*	11.11		11.44	*	12.14		12.44	*	1.14		1.44		2.14		2.44	*	3.14		3.44	*
13		28	58																A No. 12										
	H			8.17	8.20	5.17		6.17	*	P. M. 12.12		P. M. 12.42	*	1.12		1.42	*	2.12	P. M. 2.00 2.12	2.42		3.12		3.42	*	4.12		4.42	*
12¾		25	50																								B No. 18		
	I			8.42	8.40	5.42		6.42	*	1.02		1.32	*	2.02		2.32	*	3.02	*	3.32		4.02		4.32	*	5.02	*	5.32	*
11½		23	45																										
	J			9.05	*	6.05		7.05	*	1.47		2.17	*	2.47		3.17	*	3.47	*	4.17		4.47		5.17	*	5.47	*	6.17	*
6¾		14	27																										
	K			9.19	*	6.19		7.19	*	2.14		2.44	*	3.14		3.44	*	4.14	*	4.44		5.14		5.44	*	6.14	*	6.44	*

IRREGULAR TRAINS.

Distance between.....	Stations.....	Time of freight at maximum speed	Time of passenger at maximum speed....	Train. Arrive.....	Train. Depart.....	Train. Order given to.	Train. Arrive.....	Train. Depart.....	Train. Order given to.	Train. Arrive.....	Train. Depart.....	Train. Order given to.	Train. Arrive.....	Train. Depart.....	Train. Order given to.	Train. Arrive.....	Train. Depart.....	Train. Order given to.	Train. Arrive.....	Train. Depart.....	Train. Order given to.
		Minutes																			
6	A	12	24	.....	.....	....	.....	.....	....	No. 8		....	No. 12		....	No. 18		....	No. 20	A 18	...
10	B	23	48	.....	.....	....	No. 6		....	7.34	7.40	C	.....	.....	...	.....	.....	...	.....	.....	....
13	C	24	50	.....	.....	....	.....	.....	....	8.30	8.42	..	9.10	9.40	E	10.52	10.57	D	.....	.....	....
	D			No. 4 4.10	4.15	G	4.59	5.10	K	No. 10		..	10.30	10.40	....	11.10	12.15	...	.....	.....	....
8½	E	17	34	4.27	4.50	..	5.16	.....	....	.....	.....	..	11.14	11.50	F	No. 20		....	.....	.....	...
9¾	F	20	40	5.36	.....	..	5.36	.....	....	.....	.....	..	12.30	12.5[illegible]	H	.....	.....	....	1.35	1.5[illegible]	H
7½	G	13	28	No. 6		..	5.49	6.10	....	.....	.....	..	1.1[illegible]	1.20	....	.....	.....	....	2.18	2.30	J
13	H	28	58	.....	.....	..	6.30	6.38	K	.....	.....	..	2.0[illegible]	2.12	....	.....	.....	....	3.28	3.30	....
12¾	I	25	50	.....	.....	..	7.05	7.10	....	.....	.....	..	No 16		....	.....	.....	....	4.30	5.02	....
11¼	J	23	45	.....	.....	..	7.33	.....	....	.....	.....	..	.....	.....	....	.....	.....	....	No. 24		....
6¾	K	14	27	.....	.....	..	7.47	.....	....	.....	.....	..	.....	.....	....	.....	.....	....	.....	.....	....

road are properly delivered by contractors or laborers, as the case may be. This will greatly lessen the labor of estimating and facilitate the loading of the ties on cars when they have to be moved, as is frequently the case. It is a habit of teamsters to tumble ties from their wagons into the side ditches, and not unfrequently to pile them helter-skelter across the earthwork. This makes bad work when you come to estimate and mark them, and it is still more vexatious and causes great delay when it comes to distributing them for the laying of the iron. Your duty is to give your orders in this regard, and to see that they are rigidly obeyed. An engineer must exercise over the operatives of his division nearly the same absolute power that a military man holds over his subalterns. If any man sees fit to neglect or wilfully disobey orders, let him be discharged. There are plenty of good men.

ESTIMATING CROSS-TIES.

When it comes to estimating the delivered ties, prepare a pot of black paint and a small brush, put a tape line in your pocket, and take with you two strong men as assistants, to move the ties for you whenever necessary. A simple inspection of the ends of the ties when they are "ricked up," after the manner of cord wood, is often thought sufficient; but I would advise no such loose work. It is frequently the case that ties made to correct dimensions in the cross-section are so warped or twisted, or so badly lined and hewed, as to make them utterly worthless. Such defects cannot easily be discovered, unless the whole tie is exposed to inspection. A slight crook in the horizontal direction of a tie in position is immaterial, but one that "bows" or "sags" is objectionable. The slightest indication of general decay, bad knots or doted lines of wind-shake detract greatly from the value of a tie. Indeed, the matter of estimating cross-ties and other timber materials for the construction of railroads must in a great degree depend for its results, good or bad, on the judgment of the engineer. The requirements are a secure foundation for the rails, the longest possible duration of this foundation, and economy in its construction, each of which depends in whole or in part on the quality of the ties.

The subject of cross-ties will be further treated under the head of track-laying. It only remains to say just here that after you have examined a tie, if it is accepted, mark it, say with a large black dot of paint on the end; if it is rejected, mark it with a black cross.

HOOSIER.

Train Dispatching.

ST. LOUIS, MO., December 18, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The train-dispatching controversy which filled your columns a short time ago seems to have lulled, or ended without having brought forth any suggested improvements on the present style of dispatching. I venture to submit to the criticism of your readers a plan which has occurred to me. It may not be new to some of your readers, although I know of no road on which it has been tried. I submit this system as one not perfect, yet an improvement on the style now generally obtaining. Hostile criticism will not be objected to, provided *reasons* are given, not mere opinions.

The rules I have given are intended only to explain my idea, and are as few as is compatible with the object. They are not intended as a complete system.

My aim has been to introduce into the movements of trains as much regularity as possible, and to lighten the labors of the train dispatcher. At present, a train once off time remains irregular, a burden on the train dispatcher's hands. I propose to enable the train dispatcher to get rid of as many irregular trains as he can replace on the list of regulars, by putting them on the time of other trains that have also become irregular, or on the schedule time of a train that has not started from the terminus.

Regular trains are reported from every station to the train dispatcher, but beyond entering them in his table, he takes no notice of them unless to calculate a crossing for some irregular train. On a separate table before him he has the irregular trains. All those coming UP keep moving, under charge of the conductor, unless ordered to stop. The train dispatcher has, therefore, but to think of and calculate for his DOWN trains.

The conductors and enginemen of all UP trains and of DOWN regular trains as they approach a station consult the table for that station, and at a glance ascertain whether an opposing regular is due, or whether they can go on, if no order signal be against them.

There are several objections to this plan that have occurred to me; but none, I think, that make it a worse one than the system now in operation. I should like to hear from practical men what they think of it—whether it would lighten the dispatcher's labor or not.

HARRY E. SHARPE.

1. The time-table of the road must contain more trains than are likely to be required. If the traffic be heavy, say the table shows one train every half hour.

2. The road should be divided for the purpose of despatching into districts as nearly 200 miles in length as is convenient.

3. The despatcher's office, known as "D. S." should be in the center of the district, so that with two despatchers, each one has no more than 100 miles immediately under his control. The number of miles, however, must depend in a great measure on the quantity of traffic.

4. Trains moving from D. S. are DOWN trains; those coming toward D. S. are UP trains.

5. All UP trains will have the right of way and keep running regardless of all but schedule trains and those specified in train orders.

6. All DOWN trains will run without train orders, if on time; but if ten minutes late, they become irregular and must not leave any telegraph station without an order, nor any flag station unless flagged.

7. UP trains, not finding the expected train at a schedule meeting point, must not start without a train order from the next station, stating that the expected train has not left that station. On receipt of such order, the train will run on, regardless of the other train, which has now become irregular.

8. When a train falls off time, it becomes irregular, and must be so specified in all train orders. Thus, "No. 1, irregular."

9. The train dispatcher may, as often as he finds it practicable, restore an irregular train to the schedule by giving it another number, if the train of that number has also fallen off time, or if no train of that number started from terminus.

10. A train taking a second number shall be designated by both numbers, with a letter of the alphabet between. Thus, No. 1, having been put on time of No. 3, will be designated 3 A 1; if again put on time of another train, No. 5, it will be known as No. 5 B 1. The letter of the alphabet being used to indicate the number of changes.

11. When no train is ready to start from terminus at the time designated in schedule, the train dispatcher will cancel it over the whole district, or over as many stations as may be necessary.

12. At schedule meeting points a memorandum from the station operator that a train has been cancelled is sufficient authority for disregarding that train.

13. At every station there shall be exhibited at the door of the telegraph office a printed table, showing time of arrival of schedule trains, as below:

ST. MARY'S STATION—SCHEDULE ARRIVING TIME OF TRAINS.

Down.

Distance between stations, Miles.	Due to leave. Atlanta.	Train.	Time due.
15	5:30 a. m.	1 Pass.	6:00 a. m.
16½	6:10 "	3 Acc.	6:45 "
5	10:40 "	13 Freight.	11:00 "
10	1:30 p. m.	5 Pass.	2:00 p. m.

Up.

Leaves Jamestown.			
4	6:45 a. m.	2 Pass.	7:00 a. m.
12	8:30 "	4 Acc.	9:00 "
16	11:10 "	6 Acc.	12 00 noon
10	2:35 p. m.	8 Freight.	3:00 p. m.

The table below is intended to illustrate this method of dispatching. It shows DOWN trains only.

No. 2 runs on time to station D. The arrival column is therefore marked with a *: but at some stations it varies a little, and so the actual time is filled in, sufficient time not being lost to make the train irregular.

No. 4 runs on time to D, but there becomes irregular, and so

is struck off the regular sheet and transferred to the irregular sheet, and canceled for all stations in advance of D.

No. 6 starts on time, but at D is off time and transferred to the irregular list as "No. 6, irregular." No. 4 being so far behind as to be nearly on time of No. 6, the train dispatcher restores it to the regular list as "No. 6 A 4," and so gets rid of it.

No. 8 starts on time; at B is detained and thrown out of time. Train dispatcher, D, finding that no other train requires the time, cancels that train for all stations in advance from B.

No. 10 is a blank train, introduced into the table for use of delayed trains. At starting time, no train being ready, train dispatcher cancels No. 10 for A and B stations; but at C station he finds No. 8 irregular delayed, and so restores it to the regular list as "No. 10 A 8."

No. 12 starts on time, becomes irregular at C, and is transferred to the irregular list; its time not being wanted for any other train it is canceled by the train dispatcher.

No. 14 keeps on time and passes No. 12 irregular.

No. 16 has been canceled by train dispatcher up to station H, when its time is required for No. 12 irregular, which then is restored to the regular list as "No. 16 A 12."

No. 18 becomes irregular at C, is put on time of No. 20 as "No. 20 A 18," but gets off time again at F, is passed by No. 22, and is a second time restored to the regular list as "No. 24 B 18."

Formula for Contents of a Prism.

ST. JOHNSBURY, Vt., December 19, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I send a formula, adapted from the prismoidal formula, for the contents of such a prism as usually occurs on railroad work—center and outside heights given and slopes 1½ to 1. I have not yet met with it in the course of my reading. If it is new, and you think it worthy, you can publish it for the benefit of the craft.

Let b = width of base; H, H' and H'' and h, h' and h'' center and outside heights at the ends; L = length, C = contents.

$$C = \frac{L}{8}\Big[\, b\,(2H + 2h + H' + H'' + h' + h'') + H\,(2H' + 2H'' + h' + h'') + h\,(2h' + 2h'' + H' + H'')\Big]$$

This reads, in an easily applied

Rule.—To the product of the width of the base into twice the center plus the outside heights, add the product of each center height into twice its own plus once the opposite outside heights: multiply this by the length and divide by 8.

For a slope of 1 to 1, the formula is:

$$C = \frac{L}{12}\Big[\, b\,[3\,(H + h) + 3\Big(\frac{H' + H'' + h' + h''}{2}\Big) + H\,(2H' + 2H'' + h' + h'') + h\,(2h' + 2h'' + H' + H'')\Big]$$

JOHN E. EARLEY.

Erroneous Report of a Boiler Explosion.

MEADVILLE, Pa., December 26, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I would call your attention to an erroneous report of the accident that occurred near Bowlusville, O., on this road, as published in the GAZETTE of December 21.

The engineman was *not* overworked, but, on the contrary, was off duty at least thirty-six hours before taking his train.

The boiler *did not leak badly*, but was in good order and did not leak at all.

No cars were piled together, as reported.

The cause of the explosion was want of water, it being several inches below the crown sheet at the time. Several of the top rows of flues were burnt off. The crown sheet became red-hot, and under the pressure was driven down into the firebox, causing a rupture in the flue sheet and side sheets.

Will you please make the correction in your next issue and oblige.

Respectfully yours,

J. VAN VECHTEN,

General Master Mechanic.

[The report of the accident given in our columns was founded on accounts published in Ohio newspapers, which assumed to give the fireman's conversation on the subject. As printed in the GAZETTE, it is: "The latter [the fireman] reports that the engineman had been overworked and lacked sleep, and had remonstrated against making this trip." This was the best information we had and was therefore used. We suggest that it would be well if master mechanics would send us accurate accounts of the circumstances attending boiler explosions, and especially of the position and manner of the rupture in each case. Valuable lessons might be learned by comparing such accounts.—EDITOR RAILROAD GAZETTE.]

On the Strength and Proportions of Riveted Joints, With the Results of Some Recent Experiments.

[Paper read before the Institution of Mechanical Engineers by Mr. Walter R. Browne, of Bristol, at the meeting in Birmingham, England, January 25, 1872.]

The strength of riveted joints is a question which has engaged the attention of several eminent engineers, and a considerable number of experiments have been made on the subject. Not having succeeded, however, in meeting with any thorough investigation on mathematical and practical principles combined, the writer has now attempted this in the present paper.

Taking first for consideration the simplest case of a single-riveted lap-joint with a single rivet only, as in Fig. 1, this joint may give way under a tensile strain in either of the following modes.

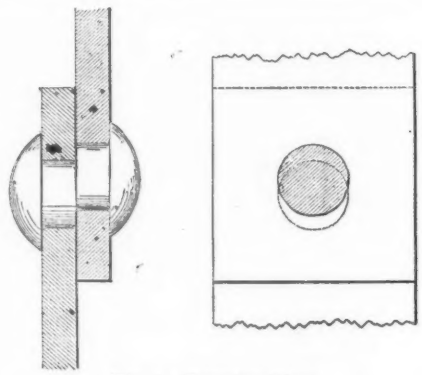


Fig. 1.—Shearing Rivet.

1st. The rivet may shear, as in Fig. 1; and in that case the breaking strain equals

shearing strength per square inch × sectional area of rivet.

2nd. Either plate may be crippled, that is crushed by the rivet forcing itself into the plate, as in Fig. 2. In this case the

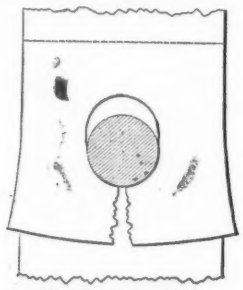


Fig. 2.—Crippling.

actual resistance offered by any portion A B of the circumference, Fig. 6, to the tensile strain, equals its resolved portions C D at right angles to the line of strain, multiplied by the thickness of the plate and by its crushing strength. Hence the whole resistance offered by the plate to crippling equals

crushing strength × thickness of plate × diameter E F of rivet.

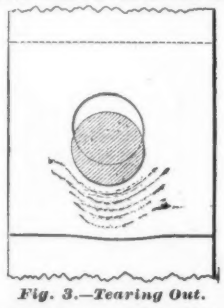


Fig. 3.—Tearing Out.

3rd. The rivet may be torn out of the plate, as in Fig. 3, the plate breaking at the line K L. Then the part of the plate E M N F that is opposed to the rivet may be considered as a continuous girder uniformly loaded, and the ultimate resistance consequently equals

$$\frac{\text{thickness of plate} \times (\text{depth K L})^2}{\text{length E F}} \times Q$$

the constant Q having to be determined by experiment, as the circumstances differ so much from those of ordinary girders.

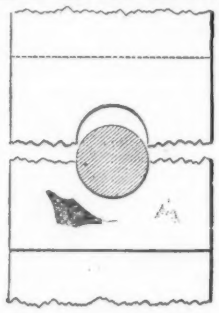


Fig. 4.—Tearing Across.

4th. The plate may tear along the line G E F H, as in Fig. 4; and then the ultimate resistance equals

tensile strength per square inch × thickness of plate × (G E + F H)

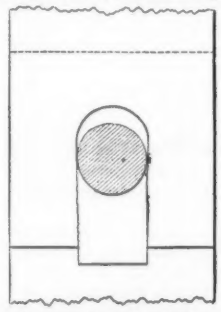


Fig. 5.—Shearing Plate.

5th. The rivet may force a piece of plate out before it, as in Fig. 5, the plate shearing along the lines E M and F N; and the ultimate resistance then equals

shearing strength per square inch × sectional area sheared.

This mode of fracture has been considered by one authority, Mr. Reed, as the normal manner in which a rivet forces its way out of a plate; but in the writer's opinion there is not any reason for believing such an action to occur, and the form of fracture in Fig. 5 could not take place before that in Fig. 3. It would be a similar occurrence to that of a uniformly loaded iron arch shearing at the two spandrils instead of breaking at the crown.

Omitting then this last case, the four modes of fracture to be considered are those shown in Figs. 1, 2, 3 and 4; and in a perfect joint the resistance in all these cases should be equal, and in all the greatest possible. Taking the expressions already given for these several resistances, it is seen that—

No. 1 depends only on the diameter of the rivet.
No. 2 depends on the diameter of the rivet and the thickness of the plate.
No. 3 depends on both these, and the distance of the rivet from the end of the plate.
No. 4 depends on the thickness of the plate and the width on each side of the rivet.

Then by comparing Nos. 1 and 2 the proper proportion is obtained between the diameter of the rivet and the thickness of the plate; by comparing No. 1 with No. 3 the proper distance of the rivet from the end of the plate is obtained; and by comparing No. 1 with No. 4 the width of the plate is determined, or the pitch of the rivets where there are several.

SINGLE-RIVETED LAP-JOINTS.

First to compare the modes of fracture Nos. 1 and 2; let t be the thickness of the plates, and d the diameter of the rivet, the area of which will be $\cdot 7854\, d^2$; P the strain per square inch that will cripple the plate, and S the strain per square inch that will shear the rivet; then

$$S \times \cdot 7854\, d^2 = P \times td$$

$$\text{or} \quad \frac{d}{t} = \frac{P}{\cdot 7854\, S}$$

for the proportion of the diameter of rivet to the thickness of plate.

The values of P and S have now to be fixed; and in reference to P, the strain that will cripple the plate, the writer does not know of any direct experiments published on this point. If the ordinary values for the crushing and shearing strength of wrought iron are taken, the result obtained is that the diameter of rivet equals the thickness of plate very nearly, a proportion that is quite opposed to practice. This discrepancy arises from the circumstance that the experiments for values of crushing strength are made with cubes or short bars of the metal, which are free to move laterally in all directions; but in the present case on the contrary the metal that is being crushed is supported both by the surrounding part of the plate and also by the heads of the rivet, and is consequently much stronger.

One case in point is that of the fracture of suspension-bridge links, described by Sir Charles Fox,* which was apparently due to this cause; the holes became elongated, the bearing surface of the link against the pin was thickened, and after fracture the inside edges of the broken link could not be brought together again in consequence of their lateral enlargement. The values of P derived from these experiments are 40·0, 40·0, and 41·5 tons per square inch. Other values 38·1, 39·3, 40·6, and 41·4 have been obtained from data kindly furnished to the writer by Mr. George Berkley from similar experiments,† taking only those cases in which the fracture was clearly due to the crippling of the link.

As however in both these sets of experiments a single pin with links of best bar iron was employed, it seemed very desirable for the present object to make some further experiments with actual boiler plate and rivets; and for this purpose a series of plates were prepared, and were tested for the writer at Mr. Kirkaldy's works; the whole preparation for the plates and also part of the expense was borne by Messrs. Fox, Walker & Co., of the Atlas Iron Works, Bristol. In order to make sure that the joints should yield by this mode of fracture and no other, the rivets were made altogether out of proportion to the thickness of the plates, which was 5-16ths inch, while the rivets were 1 inch diameter; ample width was also given to the lap. The width of the joint in the line of the rivets was 13 inches, and three rivets were employed in all the cases. Half the specimens experimented upon were made with a lap joint, and the other half with a butt joint and two cover plates; the pitch of the rivets was 2 inches in the lap joints, and 3½ inches in the butt joints. The results of these experiments are given in the appended Table I.

On the plates being tested by tension in Mr. Kirkaldy's machine, they all without exception tore through the rivet holes, as in Fig. 4. But the tensile strength per square inch of the area fractured was greatly below the strength of the plates, being only an average of 12·2 tons in the lap joints and 13·2 tons in the butt joints, as seen in Table I; and it follows therefore that the joints could not have yielded by fair tearing of the plates. The crippling action at the rivet holes, which is now being inquired into, would injure and weaken the metal, until either the rivets forced themselves out of the plate, or the plate itself tore through the holes. The latter happened first in these experiments; but there is no reasonable ground, the writer believes, for doubting that the ultimate cause of failure was the crippling of the metal in front of the rivets.

In order to test the reality of this crippling action, similar specimens of all the three qualities of iron that had been used, and of both kinds of joint, were subjected to a total tensile strain of 36 tons on the 13 inches width, and the rivet heads were afterward planed off, so as to examine the dimensions of the holes. A slight but unmistable elongation was found to exist in the direction of the strain, amounting to about 1-20th inch; and taking into consideration that this is of the character of a "set," and also bearing in mind the way in which the metal is grasped by the rivet heads, and the support given by the surrounding plate, the amount of elongation appears quite sufficient to prove the existence of the crippling action. At the same time the ultimate tearing of the plates at the rivet holes serves to show why this crippling has attracted so little notice; and that, when not carried so far as to result in tearing, it may still exist as a dangerous and unsuspected source of weakness in joints otherwise excellent.

The mean value obtained from the experiments for the ultimate resistance to crippling of the plate, per square inch of the area of pressure in the rivet holes, is shown in Table I. to be 39·5 tons for the lap joints, and 42·9 tons for the butt-joints. These show a very close agreement with the results previously obtained from the experiments with suspension-bridge links, which averaged 39·8 and 40·5 tons per inch. The resistance to crippling appears, therefore, to be very different from and independent of the tensile strength of the iron; and, as a general result, 40 tons per inch may be taken as the strain that will cripple the plate, or the value for P in the calculation.

Next, to determine the value of S, or the strain per square inch that will shear the rivet. A considerable number of experiments have been made on this head, but their results do not agree very well together. In experiments made for the Britannia Bridge,‡ Mr. Clark found the shearing strength of rivets was only 20·4 tons per sqare inch for single shear. Only 18·82 tons for single shear has been given by Mr. Doyne as the average result of experiments; and as much as 26·50 has been given as an average by Mr. Maynard. The result of 22·70 tons was obtained by Mr. Reed§ from experiments made at Chatham upon ¾ inch rivets of Low

* Proceedings of the Royal Society, vol xiv.; and Proceedings of the Institution of Civil Engineers, vol. xxx.

† Proceedings of the Institution of Civil Engineers, vol xxx.

‡ The Britannia and Conway Tubular Bridges, vol i., page 392.

§ Treatise on Iron Shipbuilding, ch. xvii.

Moor iron; 22·20 is the result of two experiments* with ¾ inch rivets by Sir William Fairbairn; and in eight experiments† by Mr. Henry Sharp upon steel plates jointed with iron rivets, the result ranged from 16·76 to 20·78 and averaged 18·68 tons per square inch. The low value obtained in these last experiments is probably due to the circumstance that the steel plates, being harder, cut into the rivets sooner than iron plates would have done. Some similar explanation might possibly be found for the low result of 18·82 tons in Mr. Doyne's experiments; but, on the other hand, the result of 26·50 tons in Mr. Maynard's experiments seems exceptionally high. The result of 22·70 tons obtained in Mr. Reed's experiments, which were made with great care, is supported by the 22·20 tons of Sir William Fairbairn's experiments, and thus seems the most reliable; but as these experiments were made with the best quality of material, Low Moor iron, it will be safer for general purposes to take 22 tons per inch as the shearing strength of the rivets, or the value of S for single shear.

Taking this value, and the 40 tons per inch previously ascertained as the value of P or the crippling strength, the expression for the proportion of the diameter of rivet to the thickness of plate

$$\frac{d}{t} = \frac{P}{\cdot 7854\, S} \quad \text{becomes} \quad \frac{d}{t} = 2{\cdot}31$$

giving the result, diameter equals 2·31 times thickness. It thus appears that the ordinary rule of making the diameter of rivet double the thickness of plate is nearly correct, giving, however, some advantage to the plate. This proportion of 2 to 1 will therefore be retained in the investigation of the other points in question; and the diameter of the rivet will be taken throughout as the basis of comparison, whereby a sufficient thickness of plate will be insured.

The next step is to equalize the strength of the joint in the first and third modes of fracture, or to determine the distance of the rivet from the edge, or the lap of the plate, which will give the same resistance to tearing the rivet out of the plate as to shearing the rivet in the hole. Putting a for the distance

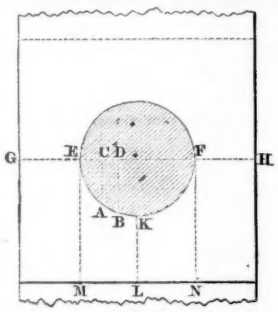


Fig. 6.

required, K L, Fig. 6, the equation becomes

$$S \times \cdot 7854\, d^2 = Q \times \frac{ta^2}{d}$$

the value of Q having to be determined by experiment.

Three experiments of Sir William Fairbairn, in which the rivets are said to have torn out of the holes, are the only ones the writer has met with bearing on this point‡; and these give the values of 32·6, 37·9, and 44·9, or an average of 38·2 tons for Q. Taking $Q = 38$, and the other values as before, namely $S = 22$ and $d = 2\,t$, the result is that

$$\frac{a}{d} = 0.95$$

or the proportion of the distance of rivet from end of plate to the diameter of the rivet itself should be 0·95. Thus the ordinary rule of having a space equal to one diameter between the rivet hole and the end of the plate proves to be substantially correct, when the diameter of rivet is double the thickness of plate; and the lap of the joint then becomes three times the diameter of rivet.

When however the diameter of rivet is less in proportion, as must be the case with thick plates, the result is different, and if the diameter is only 1½ times the thickness, or $d = 1\frac{1}{2}\,t$, then

$$\frac{a}{d} = 0{\cdot}82$$

or the distance from end of plate is reduced to a proportion of 0·82, or 4-5ths diameter of rivet.

Lastly the strength of the joint has to be equalized in the first and fourth modes of fracture, so that the width of plate on each side of the rivet hole shall offer the same resistance to tearing the plate as the rivet does to shearing. Putting b for the width required on each side of the hole, the equation becomes.

$$S \times \cdot 7854\, d^2 = R \times 2\, b\, t$$

where the value of R or the strength to resist tearing has still to be determined; for which purpose the following data are available.

In the experiments by Mr. Reed before referred to this value is

18 tons per inch for punched plate.
22 tons per inch for unpunched plate.

In the experiments§ of Sir William Fairbairn with single riveted lap-joints this value averages

19·9 tons per inch for the riveted plates,
and 25·0 tons per inch is stated for the unpunched plates.

In other experiments with double-riveted and butt-joints higher values were obtained. The results of a series of experiments on double-riveted and butt-jointed plates, made by Mr. Brunel, and communicated to the writer by Mr. Howard, Engineer to the Bristol Docks, bear fairly upon the present point, and give a mean value of

18·25 tons per inch for the riveted plates, mean of 6 experiments,
20·00 tons per inch for the unpunched plates, mean of 5 experiments.

These values are considerably lower than those in Sir William Fairbairn's experiments, although obtained from double-riveted and butt-jointed plates; and this probably arises from the iron in the latter experiments being of better quality, possessing the unusually high tensile strength of 25 tons per inch; the plates were also thin in that case, being less than ¼ inch thick, which would render them proportionately somewhat stronger. Hence for general purposes it seems safer to take 18 tons per inch as the tearing strength of the plate at the rivet holes, or the value of R, as this value is confirmed by Mr. Reed's experiments. Taking then 18 tons for the value of R, and $S = 22$ tons as before, in the equation

$$S \times \cdot 7854\, d^2 = R \times 2\, d\, t$$

the result obtained is

$$b = 0.48 \times \frac{d}{t} \times d.$$

And if the diameter of rivet is taken at twice the thickness of plate, as before, or $d = 2\,t$, then

$$b = d\ 0.96 = d \text{ very nearly.}$$

and the result is that the width on each side of the rivet-hole should be equal to the diameter of rivet in the case of a single rivet, so that in a row of rivets the space between them should be equal to twice the diameter of a rivet, or as a practical rule the pitch should be equal to three diameters.

With thick plates, where the diameter of the rivets is less than twice the thickness of plate, the pitch will be less; and if m be taken as the ratio of diameter to thickness, then

$$b = \frac{m}{2} \times d$$

or the space between the rivet holes will be m times the diamter of rivet.

If the plates are drilled instead of punched, the strength of the portion between the rivet holes will not be reduced below the general tensile strength of the plate, which may be taken at 22 tons per inch from Mr. Reed's experiments already referred to†; and substituting this value for R,

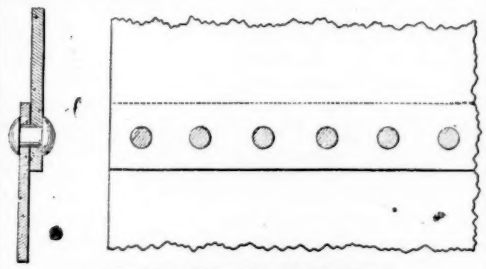
$$b = 0{\cdot}39 \times \frac{d}{t} \times d,$$

and if $d = 2\,t$, then

$$b = 0.78\, d,$$

or the proportion of the space between the rivet holes becomes 1·56 times the diameter, and the pitch equal to 2⅜ diameters.

With regard to the proportionate strength of the plate at the joint compared with that of the entire plate, the sectional area of the plate is reduced to two-thirds at the line of rivets, when the pitch is 3 diameters; and the strength of the metal between the rivet holes is further reduced in punched plates from 22 to 18 tons per inch, making the total strength at the joint ⅔ × ¾ or 55 per cent. of that of the entire plate, with punched holes. With drilled holes having the pitch of 2⅜ diameters, the tensile strength of the metal not being reduced by punching, the proportionate strength is in the ratio of 1⅜ to 2⅜, and is therefore 62 per cent.



Figs. 7 and 8.—Single-Riveting.

The rules thus obtained for the proportions of single-riveted lap-joints are accordingly as follows, as shown in Figs. 7 and 8:

Diameter of rivet	= 2 times thickness of plate,
Lap	= 3 diameters,
Pitch	= 3 diameters.

Taking, however, a 1½ inch rivet as the largest that can be worked in practice, this rule of the diameter equal to twice the thickness cannot be followed for plates thicker than 9-16ths inch thick; but such plates are seldom used except in marine boilers, where they are always double-riveted. The above rules agree closely with Sir William Fairbairn's table in extensive use, except that for ¾ inch plates and upward the diameter of rivet is there made 1⅔ times the thickness. Other rules that are in use appear somewhat inconsistent and arbitrary; for in the case of a 9-16ths inch plate the diameter of rivet is ¾ inch by the Millwall & Lloyd's rule, 1⅛ inch by the Liverpool rule, and ⅝ inch by that of H. M. Dockyards.

DOUBLE-RIVETED LAP-JOINTS.

The case of double-riveted joints has now to be considered; and here the first point—namely, the proportion of diameter of rivet to thickness of plate—remains the same as in single-riveted joints, the rivets being under the same circumstances of strain in both cases.

The second point is the lap of the joint; for which the distance between the two rows of rivets has to be determined. The only experiments known to the writer that bear upon this are those of Mr. Brunel previously referred to. In these the line of fracture in several cases was a zigzag, running backward and forward between the two rows of rivets, as in Figs. 9

Zigzag Riveting.

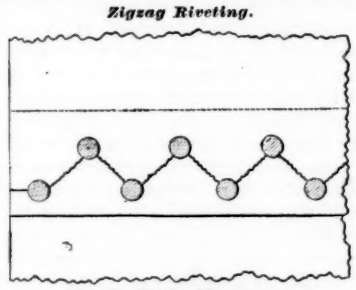


Fig. 9.—Ratio 40 per cent.

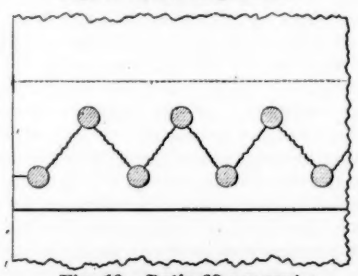


Fig. 10.—Ratio 62 per cent.

and 10, and this shows that the rows were too near together in those cases. As the effect of punching is to weaken the plate to some distance all round the punched hole, the result will be that in the space between any two successive holes in the straight line of rivets the plate is weakened twice the distance that the punching affects, but in the zigzag line between the same two holes the plate is weakened to the extent of four times the same distance. Hence, though the zigzag line will always be the longer in itself, it may be really weaker than the straight line, if the two rows are near together. The proportion of the distance between the pitch lines to the pitch itself was respectively from 40 per cent. in Fig. 9 to 62 per cent. in Fig. 10, in the experiments in which the fracture took the zigzag line; but in another experiment, Fig. 11, in which the proportion was as great

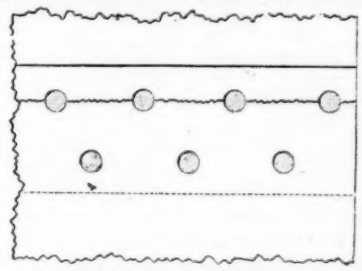


Fig. 11.—Ratio 67 per cent.

as 67 per cent., the fracture took place in the straight line. It therefore seems safe to make the distance between the pitch lines 67 per cent., or two-thrds of the pitch in zizzag riveting.

In chain-riveting, however, the rivets in the second row being opposite those in the first row, as in Fig. 12, are in the same position with respect to the first row as the rivets in a single-riveted joint to the edge of the lap. Hence, by the same rule as before, the distance between the rivet holes in the two rows will be one diameter, making the distance between the pitch line 2 diameters; but, as the plate between the holes will be injured on both sides by punching, it will be safer to make the distance 2½ diameters between the pitch lines. This gives the total lap 5½ diameters in chain-riveted joints, which agrees with the rules in use at Lloyd's.

To find the pitch for double-riveted joints, the expression will be the same as before for single-riveted joints, except that there are double the number of rivets to be sheared; and the equation will, therefore, be

$$2\,(S \times \cdot 7854\, d^2) = R \times 2\, b\, t.$$

In determining the value of R in this case, or the strength to resist tearing between the rivet holes, it has to be observed that, as the rivets are much further apart than in single riveting, the injury done by punching will be proportionately not so great; and it was found in M. Brunel's experiments with double-riveted joints that plates having a tensile strength of 20·6 tons gave a mean value of 18·2 tons for the resistance to tearing between the rivet holes. Hence the tensile strength of 22 tons that has been taken in the previous calculations the proportionate value for R will be $22 \times \frac{18{\cdot}2}{2{\cdot}06}$ or 19½ tons for tearing. Adopting this value, and taking $S = 22$ as before, the equation becomes

$$b = 0{\cdot}89 \times \frac{d}{t} \times d$$

and if $d = 2\,t$, then

$$b = 1{\cdot}78\, d$$

The result obtained is, therefore, that the pitch is to be 4.56 diameters, or say 4½ diameters in double-riveted joints. The distance between the pitch lines in zigzag riveting having already been shown to be two-thirds of the pitch, will, therefore, amount to 3 diameters, making the total lap in that case 6 diameters.

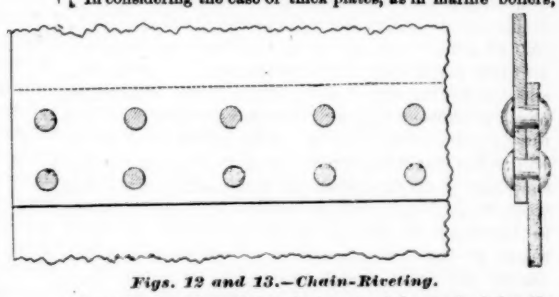
The rules thus obtained for double-riveted lap-joints, with punched holes, are accordingly, as shown in Figs. 12 and 13,

Diameter of rivet	= 2 times thickness of plate
Pitch	= 4½ diameters
Lap	= 5½ diameters in chain riveting
	= 6 diameters in zigzag riveting

The proportionate strength of the joint as compared with that of the entire plate is $\frac{19{\cdot}5}{22{\cdot}0} \times \frac{3{\cdot}5}{4{\cdot}5} = 69$ per cent. with punched holes.

If the holes are drilled instead of punched, the full tensile strengh, 22 tons, has to be taken instead of 19½ tons for the tearing strength between the rivet holes, or the value of R in the equation; and the result then obtained for the pitch is 4 diameters, instead of 4½ diameters with punched holes. The lap in zigzag riveting becomes consequently reduced with the drilled holes to 5½ instead of 6 diameters, and to 5 instead of 5½ diameters in chain riveting; and the proportionate strength of the joint then amounts to 75 per cent. of the entire plate.

In considering the case of thick plates, as in marine boilers,



Figs. 12 and 13.—Chain-Riveting.

where the diameters of the rivets cannot be made twice the thickness of the plate, the proportion of 1½ times may first be taken; and substituting this value $d = 1\frac{1}{2}\,t$ in place of $d = 2\,t$ in the previous calculations, the results are

In punched plates, Pitch = 3½ diam., Strength $\frac{19{\cdot}5}{22{\cdot}0} \times \frac{2{\cdot}66}{3{\cdot}66} = 64$ per cent.

In drilled plates, Pitch = 3⅜ diam., Strength $\frac{2{\cdot}33}{3{\cdot}33} = 70$ per cent.

Taking next the diameter of rivet equal to the thickness of plate, the corresponding results are

In punched plates, Pitch = 2¾ diam., Strength $\frac{19{\cdot}5}{22{\cdot}0} \times \frac{1{\cdot}75}{2{\cdot}75} = 56$ per cent.

In drilled plates, Pitch = 2½ diam., Strength $\frac{1{\cdot}50}{2{\cdot}50} = 60$ per cent.

[TO BE CONTINUED.]

* Useful Information for Engineers, 1st series, appendix I., part 2, experiments 30 and 42.

3 rivets, ⅞ inch diam., sheared with 16,603 lbs., whence $S = 22{\cdot}37$ tons per inch.

3 rivets, ¾ inch diam., sheared with 16,351 lbs., whence $S = 22{\cdot}03$ tons per inch.

† Transactions of the Institution of Naval Architects, 1868. The details were kindly supplied by Mr Sharp to the author.

‡ Useful Information for Engineers, experiments 25, 22 and 23.

§ Useful Information for Engineers, experiments 21, 27, 28, 29 and 33.

* Also from Mr. Kirkaldy's Experiments on Wrought-Iron and Steel, page 96.

RAILROAD GAZETTE

Published Every Saturday.

A. N. KELLOGG & CO., *Proprietors.*

S. WRIGHT DUNNING AND M. N. FORNEY, *Editors.*

CONTENTS.

Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

WARMING AND VENTILATION OF RAILROAD CARS.

On another page we reprint a letter written by Mrs. Swisshelm and one by a traveler on the Erie road, which will recall to at least some of our readers similar melancholy experiences while traveling in cold weather. To a person who has ever given much attention to the subject of ventilation, or endeavored to induce car-builders to improve existing means of supplying fresh air to travelers, the complaints of the two correspondents are not surprising.

A little investigation will soon dispose most persons to believe that the darkness and density of the popular ignorance regarding this very important subject is too great to admit of illumination by admonition or instruction. It is in fact difficult for those who have always been accustomed to distinguish pure from impure air, to realize how totally unconscious or indifferent many persons are to the *quality* of the air they breathe. To a sensitive and unreflecting person this mental, and to some extent physical, obtuseness is apt to be exasperating, as it is so utterly irrational and stupid. If we reflect, however, we will realize that it is not remarkable that ignorant people should not distinguish fresh air from foul. In the first place, many such have been accustomed from their youth to breathing impure air in their homes and elsewhere. In the next place, they seldom observe things which do not appeal in some way to their senses; and as the sense of smell, like all others, loses its acuteness if habitually used in an obtuse way, they thus do not detect any excepting the grossest impurity by its odor. It is quite difficult, too, for persons who are as much accustomed to the use of abstract ideas as they are to handling material objects, to understand how hard it is for uneducated people to grasp an idea which is not in some way recognized by the senses. As the air is a very intangible substance to ignorant persons, it is hard to make them comprehend how it may contain impurity or poison which is invisible, intangible, and to them often odorless. Therefore, while we may pardon the indignation of Mrs. Swisshelm and the Erie traveler, which was excited by the ignorance of the brakemen and conductors with whom they had the misfortune to be obliged to travel, it is nevertheless one of the elements, and perhaps the most difficult one to provide for in any system of car ventilation, and must be fully recognized in devising any plan for supplying fresh air to those who want it. Of course efforts should be made to instruct those who are ignorant, but if good ventilation is made dependent upon the success of such teaching, and the education of the class we refer to, then it will be a long time before railroad cars will be supplied with pure air. What we want now to impress upon the minds of those who control the construction and care of cars is, that they must expect to encounter this general and very dense and often obtuse ignorance, prejudice and stupidity. It must be treated like other mental infirmities, with great pity and tenderness often, but sometimes by the most arbitrary exercise of intelligent authority.

We have frequently called attention to the fact that the chief difficulty in ventilation in cold weather is that of admitting or supplying the requisite quantity of air. With reference to the quantity which is required to keep the air healthfully pure, authorities and experts in ventilation and physiology differ very widely. Their estimates vary from 400 to 1,000 cubic feet per hour for each person. Although we incline to adopt the latter and larger figures rather than the smaller, we will for the present leave that disputed point alone and assume that about 600 feet per hour should be supplied, or 10 feet per minute for each person. This would require a supply of 500 cubic feet per minute to a car occupied by 50 people.

We have heretofore called attention to the impossibility of admitting into a car any such supply of air, of a temperature below freezing, without great discomfort and even severe suffering to the passengers, and that if a supply of air at all adequate to the wants of that number of people be admitted, *it must be warmed before it escapes into the car.* We do not purpose to advocate any special method of doing this, but insist only upon the general principle stated above, and describe some of the plans in use for heating cars with warmed air.

A few months ago we illustrated and described the Spear stove, and pointed out what we considered to be some of its advantages and defects. We now give an engraving showing the Ruttan system of ventilation, as applied to the cars on the Chicago, Burlington & Quincy Railroad. Our engraving represents the ventilators as used for warm weather, but its application for heating in cold weather will be readily understood also from the engraving. Fig. 1 represents a tranverse section of the car through the air-supply shaft, *E F G*. Fig. 3 is a longitudinal section through the same shaft, and fig. 4 is a plan of the end of the car. *D* is a hood on the outside of the car with a swinging valve, designated by *E* in fig. 1, and *F* in fig. 3. Referring to fig. 3, if the car moves toward the right hand the air will be forced against the valve *F*, and press it into the position shown; and the air will enter the shaft as indicated by the darts. If the car runs in the opposite direction, the air will enter at the other end of the hood, *D*, and the valve will be swung to the opposite side. Inside the shaft, *F*, *F*, fig. 1, is a division, *F*, and at the lower end a water-tank, *G*, with a partition in the middle extending down to within a few inches of the surface of the water, as shown. The air, therefore, in entering the hood, *D*, descends on one side of the partition, *F*, as indicated by the arrows, and strikes the surface of the water, which collects a large part of the cinders and dust. The air then rises and escapes into the car by the register, *H*. In winter, no water is used in the tank, *G*, for obvious reasons, and the air-supply pipe of a Spear, or other similar stove, is attached to the air-shaft a little above the water-tank, *G*. If the register, *H*, is opened, cold air will escape into the car, but when it is closed the air will be forced into contact with the stove and be warmed. In some cases, it is distributed by a warm-air flue extending through the whole length of the car.

On the left side of fig. 1 an exhaust flue, *B*, is represented. Fig 2 is a longitudinal section of it. This flue has a hood, *A*, at the top, but no valve. *C* is the opening by which the flue communicates with the inside of the car. This opening, as will be seen, is at the bottom of the car; the idea being that, as the cold air is the heaviest, it will be at the bottom of the car, and therefore if the air be exhausted from the lower part, the coldest air will be removed, and the temperature thus be equalized. It was also assumed by Ruttan that the principal product of respiration being carbonic-acid gas, which has a greater specific gravity than air, it would fall to the floor. Now if the expired breath was from carbonic-acid gas, or if the temperature of the breath were the same as that of the external air, then probably the products of expiration would fall; but air in being breathed once gains only about 5 per cent. of carbonic acid, and its temperature as it leaves the body is usually between 90 deg. and 100 deg. It is, therefore, probable that with the air in a room at a temperature of about 65 deg. or 70 deg., the breath is of so nearly the same specific gravity that it hangs, as it were, suspended, with little tendency to either rise or fall, and that it soon mingles with the atmosphere of the room from the ordinary disturbances to which it is exposed. Besides carbonic acid, there is sulphuretted hydrogen and other gases exhaled by the human body, which, being much lighter than air, rise. If, therefore, *all* the exhaust air is taken from the floor, it is doubtful whether the carbonic acid will be carried off, and quite certain that some of the other exhalations will not be. Exhausting the air from the floor alone will, therefore, not ventilate a car thoroughly, although its effectiveness was always strongly urged by Ruttan. That it accomplishes a good purpose in exhausting the cold air from the bottom is, however, certain, and it also has the advantage that the operation by which the air escapes is seldom noticed, and therefore will not often be closed by the class of people who are so apprehensive of the effects of pure air. It is, in fact, quite unnecessary to provide any means for closing it, if a valve is placed at the bottom to prevent a descending current entering the car by the exhaust shaft. Such a valve can easily be provided by putting an iron grating over the apperture *C*, and suspending an india-rubber, leather or canvas flap over it, so that when the motion of the air in the shaft is upward the valve will open, but when it is reversed it will close.

This plan of ventilation, as applied on the Chicago, Burlington & Quincy Railroad, has also the defect to which we called attention in the Spear stove—that of having fixed hoods, *A* and *D*, for exhausting and supplying air. This evil is aggravated in the plan illustrated above, from the fact that both the currents of air, to and from the hoods, are liable to be obstructed by the raised roof or clere-story (as it should be called) of the car. As the hoods are arranged, it is necessary to provide a very large opening, so as to supply the requisite quantity of air when the wind is unfavorable, so that with a head wind more air will enter the car than can be heated, and at other times not enough. If the mouth of the hood had

Fig. 2. Fig. 1. Fig. 3.

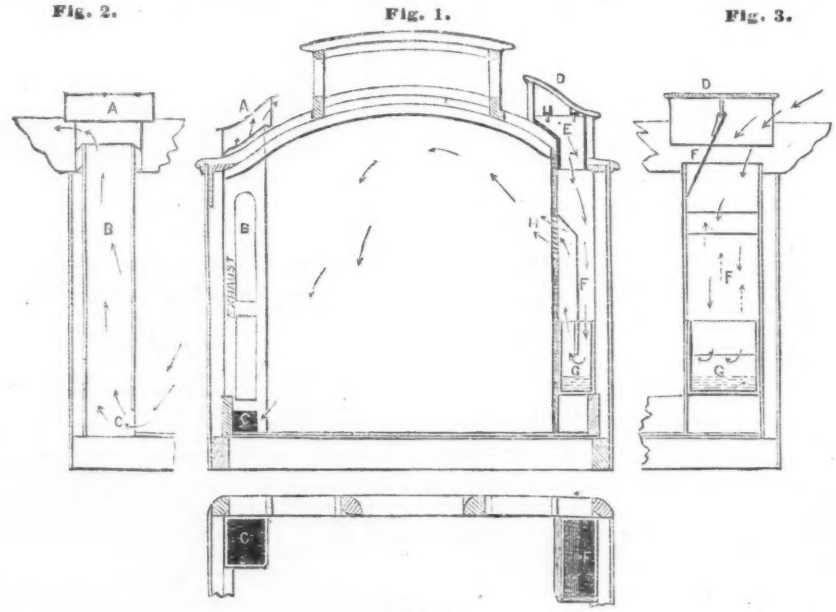


Fig. 4.

one square foot of area, and the air was calm, it would, at a speed of twenty-five miles per hour, take up, theoretically, about twenty-two hundred cubic feet of air per minute. The area of the opening of the supply hood, represented above, is about one and a quarter square feet. As each car has two such hoods, they provide for an admission of fifty-five hundred cubic feet of air per minute, when running at the speed named. With a strong head wind, this quantity might be considerably increased. Of course, the hood would hardly admit all the air which our theory would indicate to be necessary, but movable hoods, which would adjust themselves to the direction of the wind and the motion of the car, would probably admit sufficient air, if the area of each was only one-half of a square foot.

The plan we have described has now been in use on the Chicago, Burlington & Quincy Railroad for ten or a dozen years, and, with careful management, gives excellent results; but if it is neglected, or if placed in the care of ignorant or indifferent brakemen, who are apt to shut off the supply of fresh air entirely in cold weather, the air in the car becomes very impure. The difficulty is, that the supply of air under some circumstances is greater than can be warmed, and therefore passengers complain of cold. Under such circumstances the attendants are quite sure to close the fresh-air damper, which is placed in the stove-pipe, thus excluding *all* the fresh air. This evil could be remedied to some exteat by perforating the damper, so as to make it impossible to close the air passage entirely.

The great objection to the Ruttan plan is, we think, that it does not make sufficient provision for the ignorance of those who do not value fresh air, and it places those who do too much at the mercy of the attendants who have the care of the stoves and ventilators, which, as travelers soon learn by sad experience, is not usually characterized by very great tenderness.

We will return to this subject again, and consider the objections which are urged against the system of heating with warmed air.

ANNUAL REPORTS.

We fear that this is a subject which very many railroad men—perhaps most engaged in the operating dapartments—consider, if they consider it at all, with aversion. The average man, if not the average railroad man, looks upon Arabic numerals with apprehension, and before columns of them is apt to retreat incontinently; and yet annual reports, to be worth anything, must abound in such numerals, and are likely to show formidable columns of them.

Doubtless some of this disinclination to pass over reports and accounts is due to the fact that they are not easy reading. By this we do not mean that they are necessarily uninteresting; if they are what they should be, they should contain much that is very interesting to every railroad man who cares to know the results of his work; but they cannot be read rapidly and carelessly and without labor. They require a direct and sustained effort of attention. They contain much in little, and can be understood only by some thinking as well as reading, and not all of us are accustomed to such strong meat.

But those who neglect such reports altogether lose one of the best means of really comprehending their business. There are reports and reports, it is true; and some companies seem carefully to avoid as far as possible all valuable information. But all reports give some, and most reports give much, which ought to have a direct interest to every officer and employee who cares to understand his business. And it is not alone from his own company's reports that he can learn; indeed, a large part of their value consists in the power which they give of making comparisons between different lines, by which we learn the comparative efficiency and economy of different methods of working, the comparative bulk and productiveness of different kinds of traffic, the prevailing directions of travel and traffic, etc. That is, from these reports, which are or should be records of operations and the results of operations, we learn to understand the field in which railroads work, and the success of different companies in working it by different methods. Has the Northport & Southport Company worked vigorously to cultivate the through traffic between Northport and Southport, and to that end employed agents, paid large commissions, posted bills of the brightest colors far and wide, at a total expense of $6,000; then if the returns for the year show that there were 44 through travelers from Southport to Northport, and 92 from Northport to Southport, whose aggregate fares were $1,600, surely here is a lesson not hard to find, and one which the Northport & Southport passenger men will do well to learn. There are lessons more difficult to learn, it is true; and a pretty full report will bear a great deal of study, and it ought to get it from the officers of the company at least.

We have said something of the unsatisfactory nature and meagreness of some reports; and perhaps it would be well to indicate some of the things which the annual report of a railroad company ought to give.

The report is supposed to be primarily for the benefit of its proprietors—that is, its shareholders. They have entrusted their property to the care of a committee of their number and to officers who are to work it and take charge of it. They give a report of their trusteeship, and it should lack nothing which will enable the shareholder to understand clearly the condition of his property and its productiveness for the time reported.

The very first thing to be understood is the nature and condition of the property itself; the length of lines and branches, the mileage of sidings and second track; the number and nature of station houses, engine houses, machine shops, and other buildings, of lands, docks, etc.; especially of city property, the value of which may very largely affect the capital account of he company; then the equipment of the road, including the number of engines, etc., and cars of different classes. The latter will not always be sufficient without an account of the capacity of the locomotives and cars, at least where there is any considerable variation in such capacity. Having a sufficient account of the machine, we will be prepared to judge better of its working. Until we have such an account we can have no adequate idea of the value of the property. The length of a railroad is only one of the elements in its cost, value and efficiency, and we know very little of it when we know only that. It is true that it would be difficult to describe within moderate limits the condition of a railroad, but it might be done sufficiently, at least, to indicate roughly the class to which it belongs.

Knowing what the property is, the stockholder wants to know the value of his share in it; and to that end he must know not only the amount and rate of interest of its debts, but the nature of all other obligations, which are now often quite complicated—such as leases, with their duration and rental; agreements to pay percentages of proceeds of traffic of connecting roads into a sinking fund or otherwise (now a common method of securing the through traffic from new connecting roads, and diminishing to some extent the receipts available for dividends); all guarantees of the bonds of other roads, which are possible liabilities, and all other obligations which do, or in some contingencies may, affect the value of the property. This is a matter not enough considered. Contingent liabilities are very often omitted from the account, when if the contingency occurs they may make a great difference in the company's obligations.

In regard to the reports of operations, there are many considerations, varying, doubtless, with different roads, which affect their value. Gross receipts from each branch of traffic, bulk of traffic, train mileage, etc., are usually given; but it would frequently be of great value if the receipts from the different articles of traffic, the amount of each moved in each direction, the receipts and shipments of different stations were given. Comparisons of these will show the growth of industries and population and their movement, the tendencies and fluctuations of traffic, and will indicate when, and sometimes in what manner, the greatest exertions should be made to increase profitable business.

In comparing properties, and in comparing the operations of different roads, it is very useful to have some recognized unit as a standard, most conveniently a mile of road. If one road has a capital account of a million and another road one of two millions, these facts hardly help us in a comparison of the properties. But if we know that one company has $20,000 of capital stock and $25,000 of bonded debt *per mile*, and another other amounts, we have at once some ground for comparison. So we may extend our calculations to the various items in the account. The road may have .3 locomotives, .2 passenger cars, 5.3 freight cars per mile; may earn so much per mile for freight, passengers, etc.; may have cost so much per mile for fuel, train service, maintenance of road, maintenance of equipment, etc.; may had such a mileage of trains, tonnage of freight, number of passengers per mile; and when we have these facts we can make something like an intelligent comparison of the two roads. And very often in this country the increase in mileage from year to year is such that we can only compare one year's reports with others of the same road by reducing the various items in the accounts to the unit of mileage.

Usually, this reduction can be made from the figures given in any report; but it is not always possible, and frequently impossible, for figures taken from previous reports. A company may give in a table its earnings and expenses for a long series of years; but unless it gives, also, the mileage worked during each year, the figures may be very deceptive. And it is not enough to give the mileage worked at the close of the year, or even the mileage at the beginning, and the increase (or decrease) during the year: for all purposes of study and comparison we need *the average mileage worked* during the year. Give the date at which each new section was opened for traffic, and we have the means of ascertaining this average mileage.

In the above we have given but a few hints on making and studying annual reports. The subject is large, complicated and important, and deserves more attention. For the present we will be satisfied if we have induced some to study more carefully or for the first time the records of the properties they own or work.

The Vienna Exhibition.

Notwithstanding the opposition to it, the House of Representatives, as we announced last week, has made an appropriation of $100,000 to defray the expenses of exhibiting American productions at Vienna, and two United States ships have been detailed to carry articles which are intended for exhibition to and from Trieste. One of the vessels referred to will sail about the middle of February, and the other the latter part of the same month. There is, therefore, only about six weeks left in which to prepare objects for exhibition. In view of this, Commissioner Van Buren (whose office is at No. 51 Chambers street, New York) has issued the following circular:

"The exhibition opens on the first of May, and closes on the first of November, 1873. The utmost diligence will be required to enable our exhibitors to have their goods there in time for the opening, or even in time to compete for premiums.

"An appropriation will unquestionably be made by Congress, but in the meantime let every one desirous of exhibiting make application at once to this office for space.

"Blanks will be sent, on request, by return mail.

"The articles should be properly marked, and packed in strict accordance with the *directions* contained in the pamphlet sent from this office, and await the order of shipment to New York, which will be shortly issued and published.

"Any delays in following these suggestions, or neglect in properly marking and packing, will lead to serious disappointments."

Although the time remaining is very short, it is nevertheless still possible to accomplish much to aid in making an adequate representation of American productions. Probably nothing would attract so much attention as a representation of our methods of constructing and operating railroads. As it is practically impossible to send over specimens of all our bridges, locomotives, cars, etc., it would be best to do the next best thing—that is, send models of such structures made correctly to a scale of, say, for cars, etc., one-twelfth of full size, or one inch to a foot. Models of bridges might be smaller, say one-quarter of an inch to a foot. We hope engineers and bridge builders will act upon this idea, and send models of their systems of construction. There is still enough time to do this if the matter is taken in hand at once.

Master mechanics, car builders and manufacturers might do the same thing. Correctly-proportioned and well-made models of locomotives, passenger, box, platform, cattle, coal, oil, dumping, wrecking, derrick, refrigerator and other cars, snow-plows, water-tanks, etc., etc., are desirable. These should be made to represent as clearly as possible the construction and material employed, even to the method of painting. When such exhibition models are made an absurd propensity to ornament them is very apt to develop itself. As the object of a model is to represent the thing after which it is fashioned, it should be made as nearly as possible like the original, and any variation therefrom is a defect, and lessens its usefulness. Master mechanics and car builders would, we think, do well to make models of any of their ordinary cars. Let them select their ordinary cars, which, in all probability, are more perfect than others which embody novelties. What is wanted is to represent our method of "railroading," which will be to a great extent novel to foreigners. Models of cars used on the different lines would do something to advertise the roads from which they came. Such advertising would be to all the world, but more especially to a nation which, more than any other, is given to emigrating. We hope that car-builders will at once go to work, and have the models ready in time to send abroad with the vessels which will sail in February.

Besides our rolling stock and permanent works, there is an immense variety of material and devices employed directly and indirectly in the construction of railroads, and which it is impossible to enumerate in an article like this. Many of these, but especially those which are peculiar to this country, would attract attention and would be the means of communicating information regarding them to people from all parts of the world. The advantage of this to the business of this country, in a mere pecuniary sense, would be considerable, and the knowledge thus communicated to others would—looking at it in a more disinterested way—result in much advantage to human civilization and progress generally.

Commissioner Van Buren has also published some extracts from a letter from Mr. John Jay, United States Minister to Austria, in which the latter calls attention to a subject well worthy of consideration by railroad companies, but especially those which have land grants or are located through thinly-inhabited sections. In his letter

Mr. Jay says: "My impression is that if we have such an exhibition as America in all respects ought to make, it will give a greatimpulse to emigration on the part of the better class—skilled workmen, small farmers, and, gradually, of men of culture and science—and there can be nothing more suggestive of a fertile soil and pleasant home than a generous supply of fruit and vegetables.

"The Baron Schwarz Senborn hopes for rich assortments of ores from the different States, and as the time is too short for individual contributions, why should not each State and city contribute something on its own account?"

The suggestions of Mr. Jay are, we think, worthy of immediate acceptance and action by many of our railroad companies.

There seems very good ground for believing that a very large emigration could be secured by almost any railroad company which chooses to use the means suggested by Mr. Jay.

He further says that, "Our machinists—especially the builders of boilers, engines, agricultural machines, and others of all sorts—may expect to meet the most earnest competition from the large firms of England, France, Germany and Belgium; and on our success depends a vast deal in the future—particularly in view of the probability of a decline in the coal supply in England."

We trust that our manufacturers generally will make use of this opportunity of making their and the country's resources known, and that our large corporations will hasten to learn those things which the world will be ready to teach us at Vienna, if we are only ready and willing to learn.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE gives information of the completion of new railroad track as follows:

Canada Southern—St. Clair Branch.—Completed by the laying of 21½ miles of track eastward to the junction with the main line at St. Thomas, Ont. *Chicago & Michigan Lake Shore—Grand Rapids Division.*—Three miles of track have been laid on the Grand Rapids end, giving a new entrance into that city. *Providence & Worcester—Milford & Woonsocket Branch.*—Extended from Milford northward 10 miles to a junction with Boston & Albany Railroad at Ashland, Mass. *Cleveland, Mount Vernon & Delaware.*—Extended from Mount Vernon, Ohio, westward 14 miles. *Somerset.*—Completed by the laying of track from West Waterville northward 15 miles to Norridgewock, Maine. *Missouri, Kansas & Texas.*—Completed December 24 by the laying of track from the Red River southward 8 miles to Denison, Texas. *Northwestern North Carolina.*—Track laid from its junction with the Richmond & Danville Railroad at Greensboro, N. C., westward 15 miles towards Salem. *West Wisconsin.*—Extended from the junction with the La Crosse Division of the Milwaukee & St. Paul Railway at Camp Douglas southwestward about 20 miles to Elroy, the junction with the Madison Extension of the Chicago & Northwestern. *Peoria & Springfield.*—Opened December 30 from Peoria southward down the east bank of the Illinois to Pekin, Ill., 10 miles.

This is a total of 116½ miles of new railroad.

THE ERIE RAILWAY COMPANY advertises that the Superintendent of Transportation will receive proposals down to noon of the 8th inst. for the sale of the privilege of selling newspapers and other publications on all the passenger trains on the road and its branches, and at all the stations except in the ferry house and reception room at the Chambers street station in New York, for the term of one year from January 15. It is not an uncommon thing for this privilege to be sold by railroad companies—quite the contrary; but it is uncommon for the privilege to be publicly let, and in this case there is a peculiar limitation; for it is expressly stated that the newspapers and publications sold are to be such as "the President of the Erie Railway may approve." Generally we are not in favor of an Index Expurgatorius to protect readers from dangerous literature; but on trains, at least, if not in stations, the traveler will be thankful for protection against the thrusting of disagreeable, not to say vile, publications, into his face by peddlers. We are inclined to think, however, that if travelers were protected from solicitations to purchase, they need no other protection from bad literature than their own tastes and the laws of the land. One doesn't care to have his attention disturbed by the laying of any piece of merchandise in his lap, whether it be good or bad, and is not likely to take it kindly when he learns that men are duly licensed to use their arts of solicitation upon him while he is shut up in a car, utterly unable to run away from his tormentor or to turn him out of doors. Surely it ought to be possible to devise some means to make known and render accessible whatever is to be sold in trains without thrusting the various objects into the passengers' laps or faces, or soliciting them by word of mouth one after the other, so that each one must hear the torture of his neighbors, as well as bear his own. Couldn't our purveyors have a card at each seat, or less numerously, if they will be suited so, containing a catalogue of the necessaries, comforts or luxuries, literary or comestible, which they may have on board to sell, with prices attached, so that you, most respected reader, may order your *North American Review* or *Nation*, your sandwich or banana; and Plebeius, your neighbor on the back seat, may send for the "Red Robber of the Haunted House" or the *Police Gazette*, his gingerbread or peanuts, as quietly as if you were under your own vine and fig tree—or elsewhere than in a railroad car. Doubtless many would buy little if the goods were not presented before their eyes, and their wants cultivated and developed. But this submitting of travelers to the mercies, not always tender, of the solicitor is just what they complain of, and, it seems to us, with great justice, too. The railroad companies may properly provide that certain articles be sold to travelers on trains, but they should also provide that their passengers be not annoyed by the manner of the selling.

THE OHIO RAILROADS, according to the report of the State Commissioner of Railroads and Telegraphs for the year ending June 30, 1872, at that date measured in the aggregate 3,787 miles in length (including only the mileage within the State), and earned on that mileage during the year $34,257,799, which is at the very good average rate of $9,046 per mile. The working expenses for the same time were 68½ per cent., which is probably above the average of the country, and the net earnings were about $2,840 per mile. As the aggregate cost of the railroads of the State for construction and equipment was $206,352,805 (the capital stock and funded debt were about $36,500,000 more), or nearly $54,500 per mile, the net earnings were at the rate of 5.2 per cent. on the capital invested—not a very seductive rate of profit, it must be confessed.

Fastening Crown-Bars.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Mr. Waugh has evidently taken the wrong meaning out of my remarks on fastening crown-bars. I only mean to say that screwing the bolt through the sheet and putting a nut on it is old; but screwing the bolt through the crown-bars and sheet too, is both new and novel, so far as my experience goes, and it extends over seventeen years. de S.

"Second-hand Breath" on the Cars.

Mrs. Jane G. Swisshelm has written the following letter to the Pittsburgh *Commercial*, dating from Zozonia, Indiana County, Pa.:

Among the many causes of ill-health among the American people, none is more potent than breathing foul air; and this custom is not confined to the inmates of cellars, garrets, tenement houses and slums of great cities, but is almost universal, and in few places is the supply more abundant than in our churches, public halls and railway coaches. It is in vain that builders supply means of ventilation. The sovereign people close up the flues, shut the ventilators, and shudder at the thought of that old savage oxygen breaking in upon the sacred inclosure devoted to carbonic acid gas.

On Tuesday, the 12th, I took the morning mail train at Swissvale to come to Indiana. It was a bright, crisp winter morning. There were but few people in the car, and the frequent stoppages and openings of the doors, between that and the starting point, had kept the air in the car good, although every ventilator was closed. But soon the seats began to fill up with way passengers, the stops were at longer intervals, and the air became loaded with exhalations from human lungs, human bodies and human clothing, all more or less in need of purification, and when the conductor came along I asked him to open one of the upper ventilators. Poor fellow! he looked like a second cousin to Banquo's ghost, and will, no doubt, soon be ordered to Minnesota or Florida for that pure air which is crowding in upon him in inexhaustible quantities, and which he so vigorously excludes from his sunken chest. But he looked at me as if he doubted the evidence of his senses, and replied:

"Why, we could not keep the car warm with one of them open!" Then, starting with increased surprise, he pointed to the little openings between the windows and exclaimed: "You have two ventilators open now, and this car is cold!"

I did not argue, but, when he passed, opened my window. He returned instantly, and exclaimed:

"Madame must put down that window. We cannot allow you to keep it open!"

"But," I remonstrated, "I cannot breathe this air. It is foul!"

He stood to enforce his order, and insisted that I was making every lady uncomfortable, although no one had spoken to him, so far as I could see, except a man just behind me, who was a large specimen of that class of "the great unwashed" who glory in ponderous watch-chains. Of course I could not maintain such a controversy, and put down the window; but the air was insupportable, and I went out and stood on the platform. We soon stopped, when the brakeman proposed to help me down; I told him I did not wish to get off.

"No," said the man with the watch chain, forcing his bulky person rudely past, "she only wants to cool off," and the cadaverous conductor laughed at the joke. When the train was once more in motion, the brakeman told me I must go inside, as it was against the rules to stand on the platform. I replied that it was against my rules to breathe foul air. He said no more, but went inside, and with a half dozen other men kept strict watch upon me, apparently with a view of being able to enlighten a probable coroner's jury as to whether my case had been one of suicide or accidental death.

I have known of several cases in which passengers have been subjected to great rudeness for insisting upon the use of such means of ventilation as are provided by railroad companies, and though one must pity people who supply themselves with fevers, dyspepsias and all other ills that flesh is heir to, through their ignorance of the laws of life, they should not be permitted to share their crime and its penalty. That portion of the traveling public who would rather wear second-hand clothing than breathe second-hand breath, should insist on protection from the pestilent vapors which travel all over the land in our railway cars.

A correspondent writes to the New York *Tribune* in the following strain:

The new cars which are run on most of the Erie Railway local trains are provided with ventilators in each end over the doors, like those in street cars. The cars are more perfectly ventilated by them than by any means heretofore devised—if they are open. When they are shut the cars are simply air-tight boxes, as there are no side ventilators such as were formerly used. The conductors and brakemen are strongly opposed to having the ventilators open, and they are placed so high above the floor as to be out of reach and beyond the control of the passengers, some of whom, however, may not be aware that they are suffering from foul air or where a remedy is to be found. With a roaring fire in a stove at each end of the car, the ventilators closed, and the car full of people, the air speedily rivals in impurity that of the Black Hole of Calcutta. No person can ride for an hour or two in one of these cars under such circumstances without great discomfort, and it may be serious injury.

General Railroad News.

CHICAGO RAILROAD NEWS.

Lake Shore & Michigan Southern.

This company has united with the Cleveland, Columbus, Cincinnati & Indianapolis Company in the purchase of a plot of ground, 110x120ft., at the corner of St. Clair and Ontario streets, Cleveland, on which next season the two companies propose to erect a building for the accommodation of their general offices. The plans are made for a fireproof building with five stories and basement, to cost about $300,000. The cost of the lot was $57,000

At this time the company has in its service 12,295 men, whose aggregate wages are $652,153.85 per month. Two paymasters attend to the payment of wages—T. S. Lindsey east of Toledo, and J. H. Hinkley west of Toledo.

The New Union Depot.

The plans of the great depot building which the Pennsylvania, the Milwaukee & St. Paul and the Chicago & Alton railroad companies are to build next season are now in New York, and next week prominent officials connected with these roads will hold a meeting in that city for the purpose of definitely settling upon the plans of the building. It is understood that the passenger structure will occupy the ground between West Madison and West Adams streets, and between the river and Canal street, and that the freight house will stand on the ground between West Adams and West Van Buren streets, and between Canal street and the river. But this will be settled upon at the consultation above referred to.

Chicago, Pekin & Southwestern.

The stations on the Chicago, Pekin & Southwestern Railroad have been fixed upon definitely as follows:

	Miles.	Miles.
Streator	0.	....
Reading	4.1	4.1
Ancons	2.0	6.1
Long Point	2 6	8.7
Dana	4.6	13 3
Minonk, Illinois Central Railroad Crossing	5.8	19.1
Benson	6.1	25.2
Roanoke	6.2	31.4
Eureka Junction	6.2	37.6
Eureka	.4	38.0
Cruger	2.0	40·0
Washington Junction	3.5	43.5
Washington	1.4	44.9
Coopers	3.0	47.9
Morton	4.7	52.6
Groveland	3.8	56.4
Summit	2.2	58.6
I., B. & W. Junction	4.2	62.8
Pekin	1.8	64.6
Total	61.6	

This road is not fully opened yet to traffic, but will be about the 1st of January.

Pullman Palace Car Company.

This company has contracted for the use of the whole of the fine building in process of erection on the northwest corner of Adams street and Michigan avenue. The building is 110 feet long by 52 feet in width, and is four stories in height above the basement. The building will be partitioned off and thoroughly equipped in the most perfect manner for the use of the company. The basement is to be used as a store room, and by rooms partitioned off for the use of upholsterers and sewing. The first floor will be also chiefly devoted to the purposes of a store room, and will have a finely-furnished room for the Purchasing Agent, Mr. Wm. A. Angell, and will also have rooms for the Commissary, Mr. C. A. Foster, and the Storekeeper, H. E. Keeler. The second floor contains the rooms of the Secretary, Charles W. Angell; President, George M. Pullman; Vice-President, Gen. Horace Porter; Cashier, S. A. Mosier, and General Superintendent, D. N. Welch. The third floor is devoted to the offices of A. B. Pullman, Second Vice-President; A. Longstreet, Mechanical Superintendent; W. G. Taylor, General Ticket Agent; E. B. Parks, Receiving Cashier, and N. S. Graves, Division Superintendent. The fourth floor, besides being occupied by the Accountant and his assistants, has rooms for the accommodation and amusement of the employees. Two large lunch rooms, connected by folding doors, will be provided, together with a kitchen, where the lunches will be prepared. These are for the use of the employees and laborers in the building. There will also be on this floor a large room for the use of conductors, a porter's room and a room for the Auditor, Mr. Charles H. Russell.

The entire building is to be fitted up in the most complete manner, and will be ready for occupation probably sometime in March next. The company have not yet decided anything definitely in regard to their construction shops in this city, except that they will certainly be built here. The President of the company has gone to Europe for the purpose of introducing his cars upon the prominent railroad lines there.

Pennsylvania Officers in Chicago.

Messrs. Thomas A. Scott, J. N. McCullough, Wm. Thaw and several other officers and directors of the Pennsylvania Railroad Company, were in this city recently in conference with the general officers of the Milwaukee & St. Paul Company; one of the results is reported to be a determination to build, early next season, a large passenger depot south of Madison street, between the west side of the river and Canal street, for the joint accommodation of the Pittsburgh, Fort Wayne & Chicago, the Chicago & Alton, and the Milwaukee & St. Paul railroad companies. An outline of this structure has already been presented in the GAZETTE, which is as far as the enterprise has yet progressed. It has been decided also to build a new freight house for the Pittsburgh, Cincinnati & St. Louis Company near its present freight house, and probably a passenger depot, unless arrangements should be perfected for enabling the company to use the great Union Depot mentioned above.

Street Railroad.

The Chicago City Railway Company has made arrangements to lay track on Clark street from Twenty-second street to the river, thus connecting with the North Chicago system, and will put cars on in the spring to run from Twenty-second street to Lincoln Park. It is proposed, also, to divert the cars from State street at Twelfth street, and south to Clark street.

ELECTIONS AND APPOINTMENTS.

—The stockholders of the St. Louis & Cincinnati Railroad Company met in Palestine, Crawford County, Ill., December 12, and elected the following directors: J. L. Woodworth, Palestine, Ill.; William Parker, Robinson, Ill.; David W. Odell, Oblong, Ill.; John A. Hunt, Willow Hill, Ill.; N. M. McDowell, Cincinnati, Ohio; Geo. C. Duy, L. T. Brien, Terre Haute, Ind. On the same day the new board met and organized by the election of the following officers: N. M. McDowell, President and Chief Engineer; A. B. Quackenbush, Secretary and Auditor; Geo. C. Duy, Treasurer; M. P. Wood, General Superintendent.

—At a meeting of the stockholders of the Washington County Railroad Company (of Maryland), held recently at Hagerstown,

Md., the following directors were elected: Robert Fowler, Johns Hopkins and Galloway Cheston, of Baltimore; P. B. Small, E. W. Mealey, Jacob A. Miller and George S. Kennedy, of Washington County. The board organized by electing Robert Fowler, Esq., President, and P. B. Small Secretary and Treasurer. The road is leased to the Baltimore & Ohio Company.

—Under date of December 17, a circular from E. H. Miller, Jr., Secretary of the Central Pacific, etc., announces that C. A. Grow having been appointed Auditor of the Motive Power and Machinery Department of the Central Pacific, the California Pacific and the San Francisco & North Pacific railroads, the accounts of that department are under his control and supervision, and all correspondence in relation to the same will be addressed to him.

—Messrs. F. B. Fiske, A. P. Fiske, P. Fiske, P. W. Holmes, Thomas H. Hubbard and Chauncey Vibbard, of New York, have retired from the directory of the Ware River Railroad Company, and their places have been filled by Messrs. Chapin, Rumrill and Ritchie, of Springfield, Mass., Gillett, of Westfield, and Morgan, of Palmer. The board of directors as now constituted is as follows: Chester W. Chapin, James A. Rumrill and William Ritchie, of Springfield, Mass.; E. B. Gillett, of Westfield; Franklin Morgan, of Palmer; Charles A. Stevens, of Ware; William Mixter, of Hardwick, William W. Whitney, of Winchendon; and C. A. Pery, of Baldwinsville.

It is understood that Mr. Chapin, who is President of the Boston and Albany Company, has secured a controlling interest in the road.

—At the recent annual meeting of the Dorchester & Delaware Railroad Company all the old officers were re-elected, as follows: President, W. W. Byrn; Secretary and Treasurer, T. W. Anderson; Engineer and Superintendent, D. S. Hessey. Directors: W. W. Byrn, D. M. Henry, E. W. Lecomte, Cambridge, Md.; James Gore, Salem, Md.; T. B. Sherman and John Webster, East Newmarket, Md.; John N. Wright, Fork District, Md.; Isaac M. Fisher, Seaford, Del.

—The directors of the recently-organized Boonville & Port Ontario Railroad Company are as follows: S. C. Thomson, W. Ray Tanner, Edward Crane, T. R. Sheldon, W. H. Hill, C. H. Cross, Charles A. Gurley, J. A. Cowles, H. H. Hough, R. L. Ingersoll, William H. Gilbert, J. W. Douglass and Walter Ballou.

—J. S. Morris has been appointed Superintendent of the Mansfield, Coldwater & Lake Michigan Railroad. Mr. Morris has been for a long time agent of the Pittsburg, Fort Wayne & Chicago Railway at Mansfield, O.

—Mr. W. B. Strong, for about two years past Assistant General Superintendent and General Freight Agent of the Burlington & Missouri River Railroad, on the consolidation of this road with the Chicago, Burlington and Quincy Railroad, was made Assistant General Superintendent of the latter, and so becomes chief of staff of Mr. Robert Harris. Mr. Strong, a few years ago, was General Agent of the Chicago & Northwestern, at Omaha and Council Bluffs, and was called from that place nearly at the same time by two or three new companies which wanted his services as Superintendent.

—At the annual meeting of the Galena & Southern Wisconsin Railroad Company (three-feet gauge) the old board was re-elected, viz.: M. Y. Johnson, James M. Ryan, George R. Mellville, Richard Barrett, Edward Harding. M. Y. Johnson is President, and Edward Harding Chief Engineer. The company's office is at Galena, Wis.

TRAFFIC AND EARNINGS.

—The earnings of the St. Louis & Iron Mountain Railroad for the second week in December were: 1872, $60,160; 1871, $48,971; increase, $11,189, or 22⅞ per cent.

—The earnings of the Kansas Pacific Railway for the second week in December were: from passengers, $17,365.35; freight, $37,467.20; mails, $2,055.31; total, $56,887.86. Of this amount, $2,919.20 was for transportation of troops, mails and government freight.

—The earnings of the St. Louis & Southeastern Railway (consolidated) for the second week in December were $19,273.38.

—The earnings of the Erie Railway for the week ending December 23 were: 1872, $392,687; 1871, $381,556; increase, $11,131, or 2⅞ per cent.

PERSONAL.

—It is reported that Mr. I. V. Baker has resigned his position as Superintendent of the Rensselaer & Saratoga Department of the Delaware & Hudson Canal Company. Mr. Baker is President of the New York & Canada Railroad Company, and it is said that he intends to devote all his time to the duties of that position.

—Mr. L. H. Waugh, Superintendent of Machinery of the Kansas Pacific Railway, has been presented with a gold watch and chain valued at $500 and a check for $275, by the employees of the Motive Power Department of that road. The presentation took place at Mr. Waugh's house in Wyandotte, Kan., on the evening of December 19.

—Mr. William Eurich, who has for a long time been Master Car-Builder of the Cincinnati, Sandusky & Cleveland Railroad, was recently presented with a silver-headed cane, a copy of Webster's Unabridged Dictionary and a silver cake basket, by the employees in his department.

THE SCRAP HEAP.

Train-Brakes on Massachusetts Railroads.

The Boston *Advertiser*, of December 24, gives the following statement of the number of improved brakes in use on the railroads of Massachusetts:

Railroads.	Engines.	Cars.	*Kind of Brake.*
Boston & Albany	12	52	Westinghouse.
Boston & Lowell	2	15	Smith's Vacuum.
Boston & Providence	10	61	Westinghouse.
Cheshire	..	1	"
Connecticut River	1	4	"
Eastern	30	156	"
Fitchburg	11	58	"
Hartford & New Haven	13	33	"
New Bedford & Taunton	..	3	"
New Haven & Northampton	4	20	"
Old Colony	9	44	"
Vermont & Massachusetts	..	3	"
Worcester & Nashua	1	3	Steinard steam.
Total, 13 roads	93	453	

"It may be added that the Cheshire and Vermont & Massachusetts roads have the Westinghouse brake because their cars run over the Fitchburg Railroad; and the New Bedford & Taunton uses the same brake because its cars run over the Boston & Providence road."

Railroad Manufactures.

The Chicago Car Wheel Company has filed its certificate of organization with the Secretary of State of Illinois. The capital is $50,000.

New Hampshire papers report that the locomotive works at Manchester, N. H., are running on short time, the men working only seven and one-half hours a day.

On the night of the 24th the Adrian Car Shops with six new coaches were completely destroyed by fire.

OLD AND NEW ROADS.

Lewistown Bridge Company.

This company proposes to build a new suspension bridge across the Niagara River at Lewistown, for the benefit of the Lake Ontario Shore Railroad Company. A meeting was recently held at Clifton, Ont., at which representatives of this company and of the Queenstown Bridge Company, which also proposes to build a new bridge, were present. Mr. Muir, of the Great Western of Canada, and Mr. Scovell, of the Lake Ontario Shore Company, were also present. Considerable discussion took place as to the location of the new bridge. It is probable that the two bridge companies will be consolidated very soon, and a strong effort be made to build the bridge.

Elizabethtown & Paducah.

At a special election held November 30, the the city of Louisville voted $1,000,000 for the extension of this road into the city from some point on the present line east of Litchfield. Two corps of engineers are in the field getting the work ready for letting at an early day, and it is the intention of the company to have the new line opened for business before the close of 1873.

Paris & Danville.

The charter of this company authorizes the building of a road from Danville, in Vermillion County, to Vincennes (or a point on the Ohio & Mississippi road opposite Vincennes,) *via* Paris, Marshall, Robinson or Palestine and Lawrenceville, passing through the counties of Vermilion, Edgar, Clark, Crawford and Lawrence—five of the finest agricultural counties in Illinois, which, by the census of 1872, has an aggregate population of 100,000. About thirty seven miles of the road, extending from Danville nearly due south to Paris, have been but recently opened for business, in connection with construction trains; and under these circumstances the earnings since the early part of September are reported to have exceeded the operating expenses by nearly three thousand dollars.

The whole length of the proposed road is about one hundred and five miles. The mortgage to complete the construction and equipment is $2,050,000, for the entire length of road (a little less than $20,000 per mile); and, in addition and under a special provision of the charter, the company has purchased about thirteen hundred acres of coal and timber lands, at Danville, which are reported to contain two beds of coal, each six feet thick, and now extensively and profitably mined, paying therefor $450,000 of the company's first-mortgage bonds, at par, the fee of the lands being conveyed directly to the company, and included in its mortgage for the security of the bond-holders.

Danville has recently become a railroad center of real importance, the Toledo, Wabash & Western and the Indianapolis, Bloomington & Western crossing there, and affording routes east and west by diverging lines; the Chicago, Danville & Vincennes, the Evansville, Terre Haute & Chicago, and the Paris & Danville terminating there; and a new line to the northwest, to connect with the Illinois Central, being one of the things pretty sure to be. No coal is found in Illinois south of Danville accessible to the country on the proposed line, so that it will be likely to find this road its most convenient route of supply, as it certainly will give it its most direct route to Chicago. It will also be in good position to carry way traffic on its way to or from the East, as the Indianapolis, Bloomington & Western and the Wabash line will compete for the business at the northern terminus, the Ohio & Mississippi at the intended southern terminus, and the two Indianapolis & St. Louis lines near the middle. With the Chicago, Danville & Vincennes road on the north, and the Cairo & Vincennes on the south, it would form a very direct line from Chicago to Cairo, everywhere near the eastern border of the State. The company intends to complete its line south of Paris (on which a considerable amount of grading is completed) next season.

Texas & Pacific.

The engineers making the final location of the Trans-Continental Division have reached Fort Worth, Tex., the Western terminus of that division.

The grading between Jefferson, Tex., and Marshall is all completed, with the exception of a little finishing and leveling.

A San Diego, (Cal.) date of December 15, says:

"The condemnation suits in the district and county courts, instituted by the San Diego & Gila Company, for the purpose of obtaining depot grounds and the rights of way through the city for the Texas & Pacific Railroad, were withdrawn yesterday by order of the vice-president of the former company. The Texas & Pacific Railway Company, through its attorney, C. P. Taggart, have intimated that the depot ground and right of way would not be acceptable to them unless deeds in fee simple were given by the owners of the property required."

Toledo, Tiffin & Eastern.

This recently-completed road extends from Tiffin, Ohio, northwest to Woodville, 25 miles, and also leases the Toledo & Woodville road, from Woodville to Toledo, 18½ miles long, making 43½ miles in all. It forms an extension of the Mansfield, Coldwater & Lake Michigan road from Tiffin to Toledo, and connects Toledo with the Pittsburgh, Fort Wayne & Chicago Railway. It is controlled by the Pennsylvania Company.

Ogdensburg & Water Gap.

The incorporators of the proposed line from the New Jersey Midland road at Ogdensburg, N. J., through Newton to the Delaware River, have decided to make the terminus of their road at Portland, some miles below the Water Gap. Committees have been appointed to confer with a company which proposes to build a line through Northampton County, Pa., with a view to a consolidation of interests.

Worcester Railroad Projects.

A line is being surveyed from Worcester, Mass., northeast through Boylston Center to the line of the Massachusetts Central at West Berlin. This line would be about 13 miles long and would, with the Central, form a new line from Worcester to Boston.

Another line is being surveyed from Worcester northwest through Spencer, Leicester, North Brookfield and New Braintree to Hardwick, about 26 miles. From Hardwick it will run over the Massachusetts Central and Athol & Enfield roads to Springfield. These two lines, if built, would form a loop line of the Central road from West Berlin to Hardwick, by way of Worcester.

Massachusetts Central.

The contract for this line was let about one year ago, and the present state of the work is given nearly as follows by the Boston *Advertiser*. The road, when completed, will extend from Boston west to Northampton, about 100 miles. East of Weston, no work has yet been done, and the line is not finally located. From Weston west to Hudson, about 17 miles, the grading is nearly all finished, and from Hudson to Oakdale, 14 miles, about three-quarters of the work is done. From Oakdale to Belchertown, some 36 miles further, much work has been done, and the grading on several sections has been finished by the sub-contractors. From Belchertown to Northampton, about 12 miles, the work has been done and the road is now being finally located. It will pass through Amherst and Hadley. Work on the bridge over the Connecticut River at Northampton has been commenced. In all, about 40 miles of grading has been done. From Weston east to Boston, some 12 miles, the road is not yet located, two routes being proposed, one through Waltham and Belmont to Spy Pond, and the other through Waltham and Watertown to Somerville Center.

An important agreement has been made with the Boston & Lowell Company by which a junction can be made with the Lowell road anywhere between Somerville Station and Spy Pond on the Lexington Branch. From the point of junction the Lowell Company will build a new track into Boston, on which the Central Company will run its trains into Boston, using its own locomotives. In Boston the passengers will be taken care of and the freight and baggage handled by the employees of the Lowell Company, all necessary depot facilities being provided by that company.

Midland Pacific.

Suit has been commenced against this company and also against Converse & Co., contractors, on the ground that there has been a fraudulent contract, and that stock and bonds of the company have been illegally issued to the contractors. The suing parties seek to have a receiver appointed for the road, and also to have an account of the profits on the contract. The suit is in the District Court of Otoe County, Nebraska.

Toledo, Ann Arbor & Northern.

The road-bed is nearly graded from Toledo, O., to Ann Arbor, Mich., only about five miles of grading remaining unfinished. The company intend to commence laying track early in the spring.

St. Clair & Chicago.

The preliminary surveys are being made, two lines being run, one by way of Milford and the other further south through New Hudson and Walled Lake.

Port Huron & Lake Michigan.

This company has recently completed a new machine shop at Port Huron. The old shop has also been enlarged, and the dock has been extended 400 feet.

East Saginaw & St. Clair.

Surveyors have run a preliminary line passing through Vassar and Capac, Mich.

Detroit & Bay City.

The heavy cut at Otter Lake is now finished, and iron laid through. The branch line from Lapeer, Mich., to North Branch is graded to Fish Lake, six miles from Lapeer, and it is intended to push on the grading through the winter.

Toledo & Columbus.

The Columbus & Toledo Company having finally decided to build the road on what was known as the East Line, the advocates of the West Line (through Marysville, Kenton and Findlay) have organized a company with the above name to build a road on their route. They claim to have $550,000 of local aid already voted. The new company has organized by electing the following directors: Mathew Shoemaker, J. C. Lee and H. P. Platt, of Lucas County; Henry Reed, of Wood County; Henry Brown, of Hancock; J. S. Robinson, of Hardin, and A. James Sterling, of Union. The board elected J. C. Lee, President, M. Shoemaker, Treasurer, and H. P. Platt, Secretary, who with Messrs. Brown and Robinson constitute an Executive Committee.

Marietta & Pittsburgh.

Trains are running regularly between Marietta and Cambridge, Ohio. The survey for the remaining part of the line is made and about half the grading done. The road reaches great beds of iron ore, coal, etc., in Eastern Ohio, which are expected to afford a heavy traffic.

Missouri, Kansas & Texas.

The road was completed on the 29th to Denison, Texas, eight miles south of the Red River, where it will form a junction with the Houston & Texas Central.

An arrangement has been made between this company and the settlers on the Osage Ceded Lands to make up a test case and have it submitted to the United States Supreme Court as soon as possible, in order to settle finally the right of the company to these lands.

International & Great Northern.

It is reported that work will soon begin on the extension of the Huntsville Branch, from Huntsville west through Hearne to Belton, about 115 miles.

Cincinnati & Muskingum Valley.

A meeting of the stockholders is to be held January 9, to decide the question of leasing the road to the Pittsburgh, Cincinnati & St. Louis Company. The road is 148 miles long, and extends from Dresden Junction, 55 miles west of Columbus, O., on the Pittsburgh, Cincinnati & St. Louis road, southwest to Morrow, on the Little Miami Division of the same road, forming a loop to that road. It has been for some time controlled by Pittsburgh, Cincinnati and St. Louis men.

Chicago & Michigan Lake Shore.

This company has recently laid about three miles of track on the branch from Holland to Grand Rapids, and now run trains into Grand Rapids on their own track. Heretofore, trains have run into Grand Rapids on the track of the Grand River Valley road.

Utica, Ithaca & Elmira.

The engine house of the Ithaca & Cortland Division at Ithaca, N. Y., was burned on the night of December 20. A locomotive, which was in the house at the time, was saved. The amount of loss is not stated.

St. Paul & Sioux City.

The road is now clear from snow and trains are running regularly. Snow fences are being put up at exposed points.

Lowell & Andover.

This project has been revived and proceedings have been commenced to locate the road in Lowell. Surveys are to be made of the whole line at once. The proposed route is from Lowell nearly due west to Ballardvale on the Boston & Maine road, 21 miles from Boston. From Lowell to Ballardvale the distance is about eight miles, and the new line would give a second route from Lowell to Boston only three miles longer than the present line of the Boston, Lowell & Nashua road. It is reported that a firm in Lowell has offered to take all the stock not subscribed for within a short time.

Toledo, Tiffin & Eastern.

The bridge over the Sandusky River at Tiffin, O., which was nearly completed, fell, December 17, and is a mass of ruins at the bottom of the stream.

Ohio Railroad Report.

The advance sheets of the annual report of the Ohio Commissioner of Railroads show the following statistics for the year ending June 30, 1872: Total capital stock of entire line of railroads running through or into Ohio, $219,161,127. The capital stock of that part of the roads in Ohio is $122,721,526; total funded debt of the entire lines, $217,171,755; proportion for Ohio, $120,222,072; floating debt of entire lines, $10,538,179; proportion for Ohio, $5,945,700; total length of lines and branches, 7,408 miles; of this amount, 4,787 miles are in Ohio,

Total cost of all roads for construction and equipment, $338,113,494; that portion of the lines in Ohio, $206,352,805. Gross earnings for all the lines during the past year, $65,605,074; of this sum the proportion of earnings in Ohio was $34,257,799. Total operating expenses for entire lines, $45,034,708; Ohio's proportion, $23,502,739. Total net earnings, $20,568,369; proportion for Ohio, $10,755,060. Total number of passengers carried the past year, 12,068,832; total freight carried, 20,983,068 tons; interest paid on bonds, $9,926,359. Total dividends paid, $7,554,032.

One hundred and ninety-two persons were killed by the railroads in Ohio last year, and 358 were injured. One thousand nine hundred and twenty-six animals were killed, for which damages to the amount of $45,573 were paid. The total number of persons employed on the railroads in Ohio is 25,393.

During the past year, 375 miles of road, including sidings, were built.

Peoria & Springfield.

The section between Peoria and Pekin, Ill. (about ten miles), including the new bridge over the Illinois at Peoria, was opened for traffic with an excursion on the 20th of December. This line runs down the east branch of the Illinois; the Peoria, Pekin & Jacksonville connects the same two places by a line on the west bank.

Northwestern Union.

The entrance of this road into the city of Milwaukee is being rapidly constructed and the passenger depot of the road is going up. A meeting of several leading railroad men connected with this company, the Chicago & Northwestern and the Milwaukee, Lake Shore & Western was held recently in Milwaukee, to arrange matters connected with the junction of the Northwestern Union and the Milwaukee, Lake Shore & Western roads, which latter is to use the former's entrance into the city and also its depot. This may indicate that the Lake Shore, and consequently the Wisconsin Central, which will work it, will use the Northwestern's road from Milwaukee to Chicago, rather than the Milwaukee & St. Paul's new road.

Eureka & Red Bluff.

A narrow-gauge railroad is projected to run from Eureka, Cal., on Humboldt Bay, west to Red Bluff, the present terminus of the California & Oregon road. The country through which it would pass is entirely destitute of railroad facilities. A strong effort is being made to build the road, which would be about 115 miles long.

Memphis, Carthage & Northwestern.

The grading on this road from the present terminus at Carthage, Mo., west to Oswego, Kan., a distance of about 48 miles, is very nearly completed, and arrangements have been made to lay the iron early in the spring.

Vicksburg & Meridian.

The track of this road has been extended from the present depot in Vicksburg to the Mississippi River, enabling the company to transfer freight directly to the boats.

Denver, Georgetown & Utah.

Work is to be commenced at once on this narrow-gauge road. It will extend from Denver, Col., west to Georgetown, about 64 miles. From Morrison, 14 miles west of Denver, the road will pass for four miles through a cañon, and on this section the work will be very difficult. The maximum grade going west will be 105 feet and going east 90 feet to the mile, with one or two curves of 16 degrees.

West Wisconsin.

The road is now completed from Camp Douglas, the late southern terminus, to Elroy, on the Madison Extension of the Chicago & Northwestern, and regular trains were to have commenced running December 24. The distance from Camp Douglas to Elroy is about 20 miles. Through trains from Chicago to St. Paul by this line will be put on soon.

Harrisburg & Potomac.

This company is building a railroad from Harrisburg, Pa., southwest to Waynesboro, in Franklin County, a distance of about 55 miles. Of this about 27 miles is now graded, and work is proceeding upon the remainder. The company has also commenced the grading of a branch from Dogwood Run to Petersburg. This branch it is intended to extend to Littlestown, where connection will be made with the Littlestown and Frederick & Pennsylvania Line railroads for Frederick, Md. At Waynesboro the main line will connect with the extension of the Washington County Branch of the Baltimore & Ohio road which is soon to be constructed.

Galena & Southern Wisconsin.

The locating surveys for this narrow-gauge railroad were begun last May, work on grading was begun near the end of June, and by the middle of December the grading was near completed on twenty-two miles of the line, most of the masonry on the ten miles in Illinois, cross-ties on the ground for the same ten miles, and one hundred and thirty feet out of three hundred and seventy-five of a tunnel completed. Between Galena, Ill., and Platteville, Wis., thirty-six miles, work is so advanced that when track-laying is begun at Galena, in the spring, there need be no delay until it is laid to Platteville. So far, the road has been constructed from the proceeds of stock subscriptions, which are counted on to complete the road-bed. A mortgage has been made, and bonds will be issued for the amount necessary to provide iron and rolling stock.

Union Depot at Columbus, O.

A company with a capital of $500,000 has been organized to build a new Union Depot at Columbus, O., to accommodate all the railroads which enter that city. The building will be 200 by 600 feet.

Buffalo, New York & Philadelphia.

The last rail completing this road from Buffalo to Emporium was laid on the 23d. The road is 117 miles long, and opens a route from Buffalo to Philadelphia 416 miles, to Baltimore 394 miles, and to Washington 434 miles long.

Paris & Decatur.

The last rail of the joint track of this road and the Chicago & Illinois Southern has been laid, completing the track from the junction of the two roads at Mt. Zion to the point where they intersect the Illinois Central, one and one-half miles south of Decatur, Ill. The distance between the two points is about nine miles. The road is being ballasted and trains will shortly commence running.

Pennsylvania & Delaware.

On the southeastern end of the road the track is laid to the crossing of the Delaware Railroad near Rodney, and trains run regularly from Delaware City to Rodney. The distance between the two places is about seven miles.

Pennsylvania Petroleum.

The Secretary writes us the following concerning this railroad. "This road when completed will extend from Tidioute, Pa., on the Allegheny River, where it connects with the Oil Creek & Allegheny River Railway, to Erie, Pa., 67 miles, passing through the great oil fields of Dennis Run, Triumph, Colorado and Enterprise, thence through Titusville, via the Muddy Creek valley to Cambridge, where it crosses the Atlantic & Great Western Railway, thence through Edenboro, Compton and McKean to Erie. The line from Cambridge to Erie passes through one of the finest farming regions in the State. There will be a branch from Colorado to Pithole City, 11 miles, which will connect the Pithole Valley Railway (controlled by this company), traversing the oil districts of Pleasantville, National, Red Hot, Shamburg and West Pithole. Six miles of the branch between Pleasantville and Pithole is graded ready for the iron. About 30 miles of the main line, between Tidioute and Cambridge is ready for the track, except two or three heavy cuttings, which will take some time to complete on account of the small number of men that can be worked to advantage. Six miles of track has been laid between Cambridge and Titusville, but on account of the deep snow and the extreme cold weather (thermometer 12 to 24 degrees below zero) we have suspended work except in the heavy cuttings. We have already expended about one million dollars. (The line when completed and equipped will cost about four million dollars.) The main line will be of steel rails, which have been negotiated for and are now on the way to New York. The company have also purchased 1,500 iron rails, which have all been received.

"The grading through the city of Erie is completed except a tunnel under the Lake Shore Railroad tracks. Considerable work has been done on the docks in the harbor of Erie. The city of Erie has done nobly towards this enterprise. They donated twenty water lots (which gives a harbor frontage of about one thousand feet) and the right of way the entire length of the city for double track. The statement that the road has track from Pithole to Petroleum Centre is a mistake, the road does not pass through Petroleum Centre.

South Carolina.

This company purposes to retire its floating debts and bonds not secured by mortgage by an issue of 7 per cent. second-mortgage bonds to the amount of $3,000,000. This is at the rate of about $12,500 per mile of road, and the first mortgage is for the same amount. The road earns about $6,000 per mile, and its working expenses for the past four years have been on the average 58½ per cent. of the receipts.

Canada Southern.

A correspondent writes us that on Friday, December 13, the connection was made between the track westward from St. Thomas with that eastward from Amherstburg, completing that division, which is 110.4 miles long. On the 21st, only 10½ miles remained to be laid on the St. Clair Branch, which was to be completed by the 28th. At that time 60 miles of track remained to be laid between St. Thomas and Fort Erie, and two parties of 90 men each were putting down from 1½ to three miles a day each, and were to close the gap by January 10. In all 220 miles of track were laid on the 21st.

Milwaukee & St. Paul.

December 28 this company sent the following notices to the President of the New York Stock Exchange:

"The Milwaukee & St. Paul Railway Company have purchased the new line of railway between Milwaukee and Chicago and there connecting with all the principal lines of the country, in part payment for which they are to pay $2,000,000 in their common stock. You will therefore please take notice that the first said company will issue 20,000 shares of their common stock thirty days from this date."

Subsequently it was announced to the board that $2,500,000 of bonds, convertible into preferred stock, would be issued under the rules of the Stock Exchange. The bonds thus created carry with them a scrip, without which they are not a good delivery, and which must be surrendered on the conversion of the bonds. The notice in this last case was as follows:

"The scrip preferred stock of the Milwaukee & St. Paul Railway Company will after thirty days be increased 25,000 shares, or $2,500,000, to accompany the like amount of bonds issued by the company in part payment of the new line of railway between Milwaukee and Chicago, and the purchase of depot grounds and depot buildings in the city of Chicago; also for the purchase of steel rails and equipments for the general uses of the company."

This is an increase of $4,500,000 for the Chicago line, or about $50,000 per mile, being $22,222 per mile in bonds, and $27,778 in shares. A very large share of this, doubtless, will be absorbed by right of way, depot and yard grounds, and depot buildings in Chicago.

The La Crosse (Wis.) *Republican* contradicts the report that this company had offered to lay a track into the city of La Crosse, and run cars from their depot in connection with all through trains.

Montpelier & Wells River.

Work on this road has stopped for the winter. The Montpelier *Watchman* authoritatively denies the rumored lease of the road to the Boston, Concord & Montreal Railroad Company.

Boston, Hoosac Tunnel & Albany.

The officers of this new company are: President, B. F. Mills, of Williamstown, Mass.; Treasurer, E. S. Wilkinson, of North Adams; Directors, William S. Blackinton, W. W. Freeman, Harvey Arnold, S. Johnson, C. T. Sampson, of North Adams; L. L. Brown, of South Adams; B. F. Mills, John M. Cole, C. R. Tait, of Williamstown; C. P. Lapham, of Hancock. The eastern section of the road is to extend 26 miles through Adams, Williamstown and Hancock to Stephentown, where it will connect with a line to be built thither from Albany by New York capitalists. It is designed to have it constructed and in running order in season for the completion of the tunnel, and to make it the great coal carrying line from Pennsylvania to New England.

Maine General Railroad Law.

It is expected that among the first subjects to come before the Maine Legislature will be a general railroad law. This has been agitated without success for the past two sessions, but there is now a prospect of its passage.

Cincinnati & Chesapeake.

On the 28th, Cincinnati voted, by about 7,000 majority (1,000 above the required two-thirds) to issue $1,250,000 of bonds in aid of this proposed road, which is to extend north of the Ohio River, most of the way, from Cincinnati eastward to Huntington, connecting with the Chesapeake & Ohio Railroad.

Green Bay & Lake Pepin.

The track has reached Merrillon, the crossing of the West Wisconsin Railroad, 141 miles from Green Bay. This is 25 miles more track than was laid at last accounts.

New York, Boston & Northern.

This is the name of the company just formed by the consolidation of the New York & Boston, the Putnam & Dutchess and the Dutchess & Columbia Railroad companies. The Dutchess & Columbia has a road which has been in operation for two or three years from Dutchess Junction, near Fishkill, on the Hudson River road, northwest to Millerton, on the Harlem road, a distance of 59 miles. The New York & Boston Company has been at work some time on a line from New York city north to Carmel, in Putnam County, and thence northeast to a connection with the Boston, Hartford & Erie, crossing the Harlem near Brewster's, 53 miles from New York. The Putnam & Dutchess Company purposes to build a road from Carmel north to Sylvan Lake, about 20 miles, where it will connect with a branch of the Dutchess & Columbia. The consolidated company will, when its lines are completed, have a line from New York north to Millerton, about 95 miles, with branches extending from Carmel to the Connecticut line, and from Hopewell southwest to the Hudson River at Dutchess Junction. It is proposed to extend this line north from Millerton about 30 miles to a connection with the Harlem Extension road near Chatham, N. Y. It is intended to consolidate the new company with the Harlem Extension Company, and a meeting of the stockholders to vote on this proposed consolidation is to be held at the office of the company, No. 229 Broadway, New York, January 20, 1873.

Davenport & St. Paul.

The line has been located as far as Rochester, Minn., passing through Spring Valley and Frankford. The general direction is northwest.

Wisconsin Central.

The Appleton (Wis.) *Times* says that the railroad bridge over Maple Grove street in that village has been completed and cars now run through to the lake shore at Manitowoc. Regular trains will commence running early in January.

Portage & Grand Rapids.

The bonds issued by the city of Portage, Wis., to this company have been recalled and cancelled, the company having failed to build the road within the specified time.

Burlington, Cedar Rapids & Minnesota.

The annual meeting of the stockholders has been postponed to January 22, when it will be held at the Company's office in Cedar Rapids, Ia.

Lehigh Valley.

A second track is being laid on the Mahanoy Division between Myersville and Quakake Junction, completing the second track from Quakake Junction to Easton. The company is now running through cars to Sunbury over the Danville, Hazleton & Wilkesbarre road, and is selling through tickets by that route to points on the Philadelphia & Erie road.

Central, of New Jersey.

The Superintendent of the Lehigh & Susquehanna Division has offered $500 reward for the discovery of the parties who placed obstructions on the track near Minooka station on the evening of December 2.

North Pennsylvania.

Surveying parties are now locating the extension of the Doylestown Branch from Doylestown to the Delaware River, and have reached Greenville, five miles from Doylestown. The whole distance is about 10 miles, and the line will reach the river nearly opposite Lambertville, N. J.

Flemington & Delaware.

Application is to be made to the New Jersey Legislature for a charter for a railroad from Flemington to the Delaware River, a distance of about 11 miles. It is reported that this is intended as an extension of the South Branch road (Somerville to Flemington), and that it will connect with the extension of the Doylestown Branch of the North Pennsylvania road, shortly to be constructed, thus forming a continuous line from Jersey City to Philadelphia. The length of this line would be about 106 miles. The present line from Flemington to the Delaware is leased by the Pennsylvania Railroad Company, forming part of its Belvidere Division.

Allegheny Valley.

The Renovo (Pa.) *Record* reports that work on the Bennett's Branch Extension is progressing rapidly, nearly 5,000 men being at work on the line. The whole length of the extension, from Red Bank to Driftwood, on the Philadelphia & Erie road, is 109 miles.

Harlem Extension.

A meeting of the stockholders of this company is called, to be held at the office of the company, No. 9 Nassau street, New York, January 20, 1873, to vote on an agreement of consolidation with the New York, Boston & Northern Railroad Company. The Harlem Extension Company has a road from Chatham, N. Y., north to Rutland, Vt., 108 miles.

Washington County.

At the annual meeting of this company, at Hagerstown, Md., recently, the President reported that the road during the past year had proved unremunerative to the trustees. The Baltimore & Ohio Company, which leases the road, is now making surveys for an extension from Hagerstown north to Waynesboro, in Franklin County, Pa., where it will connect with the Harrisburg & Potomac road, now building. The road, which is 24 miles long, extends from Hagerstown Junction on the Baltimore & Ohio 79 miles west of Baltimore, north to Hagerstown.

Shenango & Allegheny.

It is reported that this road will pass into the hands of the Atlantic & Great Western Company early in January. The road extends from Shenango, Pa., which is on the Atlantic & Great Western road 29 miles southwest of Meadville, in a southeasterly direction to Harrisville, in Butler County, a distance of 31 miles. It is under construction between Harrisville and Parker's Landing, 22 miles further.

Natchez, Jackson & Columbus.

Work has been commenced on the first section of this road near Natchez, Miss.

Winona & St. Peter.

Track-laying on this road is again progressing.

Somerset.

The rails are laid on this road from West Waterville, Me., northward to Norridgewock, 15 miles, completing the road. At West Waterville connection is made with the Maine Central.

Cleveland, Mount Vernon & Delaware.

The rails have been laid to a point 14 miles west of Mount Vernon, O., the late terminus.

Cuyahoga Valley.

The election which was to have been held in Cleveland, O., on the question of subscribing $1,000,000 to this road, has been postponed to January 6.

Baltimore & Drum Point.

Work is to be commenced at once on the section from Camp Parole for ten miles south, and on the southern end on the section from Drum Point fourteen miles north, to Port Republic. Messrs. Crowley and Dickinson are the contractors on both sections. The Annapolis & Elk Ridge Road has passed under the control of the parties composing the Baltimore & Drum Point Company.

Providence & Worcester.

The new road from Milford, Mass., north to Ashland, about 10 miles, has been opened and trains are running. The new line forms an extension of the Milford & Woonsocket Branch north to the line of the Boston & Albany road at Ashland. The line is not very far from that of the Milford Branch of the Boston & Albany.

Boston & Maine.

The Treasurer of this company advertises for proposals for $500,000 7 per cent. bonds of that company, having 20 years to run.

St. Louis & Cairo.

It is proposed to construct a railroad from St. Louis to Cairo, on the west bank of the Mississippi. The town of St. Genevieve, Mo., has subscribed $30,000 to the project.